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The Impact of Selected Changes in Management of Public Lands on Functional Demand Areas in Utah

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THE IMPACT OF SELECTED CHANGES IN MANAGEMENT OF PUBLIC LANDS ON FUNCTIONAL DEMAND AREAS IN UTAH

by

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Eldon W. Dixon

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ABSTRACT

The Impact of Selected Changes in Management of Public Lands on Functional Demand Areas in Utah

by

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Utah State University, 1971

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Income and employment impacts associated with changing federal grazing policy were evaluated within functional demand areas.

Changes in federal land policy do have employment and income effects on the functional demand areas. But whether they are significant or not is open to debate. The percentage of total employment lost for each functional demand area ranged from .0159 percent for Region 2 to 4.031 percent for Region 7. This was the maximum employment loss or gain to the demand areas. All other gains and losses in employment within functional demand areas were between this maximum and minimum. Income changes followed a similar pattern.

It seems likely that very little actual migration of labor will take place because of the policy changes studied in this paper. More likely, the loss in employment or income due to the pricing and reduction in grazing changes will result in a higher degree of underemployment in each of the functional

demand areas, thereby generating even higher unused manpower capacity. The amount of unemployment would probably increase by some small amount also. This entails a waste of a human resource.

In the case of the increase in productivity change, it seems likely that the gain in employment or income will not create an influx of migration labor. Instead, the underemployed or individuals with unused capacity could absorb the new jobs, in which case most of the increase would show up as increased productivity. If still more labor was acquired in the area, the unemployed would be provided with new opportunities for employment.

(108 pages)

INTRODUCTION OF THE PROBLEM AND JUSTIFICATION FOR RESEARCH

With new and increasing demands for the use of public lands, policy governing the traditional uses and management have been subject for reconsideration and change. Many questions need to be answered concerning the changes in private and social costs and benefits that result with changing natural resource management.

Federal land comprises a significant portion of the total land area of the West; 65 percent of the collective land area of the 12 western states (excluding Hawaii) is owned by the federal government. These holdings in the West constitute 94 percent of all federal lands. Ninety-five percent of the total federal land is controlled by two federal agencies: the Department of the Interior with 71 percent, and the Department of Agriculture with 24 percent. The Bureau of Land Management (BLM) administers 88 percent of the land held by the Department of the Interior and practically the entire amount is in the 12 western states. The vast majority of the BLM lands is in organized grazing districts, while the remainder consists of widely scattered parcels administered under a separate section of the Taylor Grazing Act. The Forest Service administers over 99 percent of the land controlled by the Department of Agriculture. Eighty-six percent of this land is found in the 12 western states.

Grazing on the public lands is allocated to ranch operators on the basis of certain qualifications. These include prior use of the public lands before they were established as national forests or grazing districts, needs for additional forage to round out a year-long ranching operation, and ownership or control of sufficient base ranch property to provide forage and feed for animals during the time they are not grazed on federal lands. At the inception of the Forest Service, and later the Bureau of Land Management, this use was legitimized by granting grazing permits and licenses. Since these federal grazing permits give access to a factor of production which ranchers do not control in the same sense in which they control other factors of production, these associated private lands have acquired artificially high values.

Many communities have developed because of the policy of granting the original grazing permits to local users instead of transients. These communities serve as supply and demand centers for the ranching sector, and because of this long history, it will not be an easy matter to alter use patterns without causing undue economic loss to people of these communities.

It is the purpose of this paper to evaluate selected impacts on these communities which are associated with changes in federal land policy. To curtail, deny use of, or raise the use cost of federal land to the ranching operation could often mean that the community would suffer a significant economic loss. The increase in productivity on federal ranges possibly may have advantageous economic effects.

OBJECTIVES OF THE STUDY

Natural resources contained on federal lands are subject to an evolving concept of multi-use. This study will deal with changes in federal land policy which will have a direct bearing on the ranching sector and an indirect impact on the communities which serve the ranching sector. No attempt will be made to evaluate all the possible federal policy changes, only three selected ones which seem to be of interest at the present time.

Objectives

The specific objectives of this study are as follows:

1. To identify significant federal land policy changes such as:
    a. An increase in the price of publicly supplied forage.
    b. The reduction of available AUM's.
    c. Changes in productivity.
2. To determine the initial physical and monetary value of selected policy changes.
3. To delineate functional economic areas in Utah.
4. To determine the proportion of AUM's going to each of the FEA's surrounding federal lands.
5. To develop export-base employment multipliers for each FEA by the use of the minimum requirements approach.

6. To determine the income and employment impacts on FEA's by the use of regional multipliers.

The first five objectives were preliminary steps to the sixth and primary objective of the study. An unlisted objective was an effort to estimate the subjective aspects of an employment multiplier in a rural region. This dealt with the mitigating influence of underemployment on the multipliers.

The first objective was accomplished by introducing three relevant federal policy changes into the system. In dealing with the second objective the value of the AUM's lost to the ranching sector was taken to mean the cost to replace that forage supply lost due to the change in policy. The actual monetary value was the difference between the average fee for a particular area and the cost of private forage in the same area. The initial physical change was the number amount of AUM lost due to a policy change. A simple multiplication of AUM's lost and the cost differential between private forage cost and average fee gave a total monetary value to the changes in policy.

The third objective was taken as given in this study since the work had already been done by Sherman Fitzgerald (1970) for the State; it was assumed that he accomplished a measure adequate for use in this study. These areas are recognized by the State Planning Office of Utah.

The fourth objective was accomplished by obtaining the permittee's place of residence and the total number of AUM's each permittee held. These data were arranged by county and then aggregated for each multi-county region (FEA).

In completing the fifth objective, it was necessary to compile county employment data into sectors by functional demand areas. The minimum requirements technique was then applied to the data to develop an export-base employment multiplier. The export-base income multiplier was calculated using household income and capital consumption. These data were by industry into export and residentiary activities.

In dealing with the sixth objective, the estimated change in income was converted into terms of employment man years. Change in the employment multiplier was evaluated to determine the actual employment impact to the FEA associated with a stated federal land policy. The income based multiplier was also evaluated to estimate the income change and for comparison with the employment based multiplier.

SOURCES OF DATA

Mainly secondary sources of data were utilized in this study. County employment statistics for the sectoral breakdown by functional demand area were obtained from the Utah Employment Security Office. Data on permittee's residence and total AUM's held by them were furnished by the Bureau of Land Management and the Forest Service, respectively. Average fee costs and private forage costs of similar forage areas were taken from recent work of Nielson and Williams (1970). Sectoral breakdown and projects of household income and capital consumption were obtained from the 1963 Utah Interindustry Study--An Input-Output Analysis by Iver E. Bradley.

The delineation of the FEA's in Utah was from the work of Sherman Fitzgerald (1970). The coefficients used with the minimum requirements approach were used as developed by Ullman and Dacey (Ullman, Dacey, and Brodsley, 1969).

REVIEW OF LITERATURE

Introduction

This section contains a review of the literature pertinent to the objectives of this study. A brief summary of the economic base theory was set forth and is followed by three methods of analyzing the economic base. The multiplier concept was reviewed, followed by a review of its applications to the various methods of economic base analysis.

The delineation concepts were reviewed next with particular emphasis placed on the concept of functional economic areas. The section concludes with a summary of how this review relates to the specific objectives of this study.

Methods of Analyzing the Economic Base

Economic base

The theory of urban growth and development was named the Economic Base Theory by Hoyt, Andrews, and others (Pfouts, 1960). It divides urban economic activity into two categories: exporting industry that brings money into the community from the outside world, and non-exporting industries whose goods and services are sold within the region. The exporting industries are referred to as basic industries and the non-exporting industries are called service industries. Exogenous change in the basic sectors (primarily demand from

outside the region) is the cause of change in total employment, and this in turn causes changes in population, labor supply, and income (Lewis, 1969a; Pfouts, 1960).

Employment is the most widely used unit of measure in dealing with economic base studies. But using employment has several defects. Output per worker may increase tremendously in a decade and there may be differential change in the output per worker in different activities.

In order to forecast employment and income trends of a city, each of the major sources of employment must be studied in detail. In the analysis of each source of employment, it is important to note not only the future trend of the number of people who may be employed in various types of economic activity, but also the level of wages and other income and the meaning of these in terms of real income and purchasing power (Pfouts, 1960).

An analysis of the economic base involves a prediction of the nature, volume, and stability of employment and income in the region.

General measurement data of the urban base are aimed at two principal objectives. The first of these is to distinguish it in quantitative terms from the service elements of the urban economy and to establish relative quantitative positions for the basic elements. The other objective is to explain an urban economy more fully and to indicate how it can be expected to function with changes in the basic sectors. For example, the export base technique is used principally under circumstances where a more detailed technique would be costly and time-consuming. It facilitates comparison of the employment pattern of the area under study with that of the nation.

The base activity component is always computed as a constant, or unity, while the service activity element is the one which fluctuates around the base component or more precisely, is an economic function of the basic component. Assuming that each region is "normal," ratios of the basic-service relationship exist between 1:1 and 1:2, respectively. The ratio differences among regions can be caused by the nature of the base itself, geographic location, age of the region, economic cycles, and general status of the national economy.

Direct changes which occur in the basic sector, through free operation of the economy or conscious interference, are assumed to cause indirect and induced effects in the service sector. In the long run this alters their quantitative make-up and brings them back to a position of equilibrium in terms of the original ratio. Thus it provides the planner a useful basis for prediction and a means of giving ex ante appraisal to a proposal policy.

If growth does indeed alter the ratio, then the very purpose for which it is used casts some doubt upon attempts made to refine it. This could be caused by each base industry generating a different amount of service activity per unit of income or employment expansion (i.e., has its own base-service ratio) which could imply that service activities differ in their response to base expansion.

Location quotient

The first method of economic base analysis discussed was the location quotient. The "location quotient" is the percentage of employment in a given local industry of total local employment, expressed as a ratio to the percentage

of national employment in the same industry of total national employment. The "location quotient" suffers from measuring an irrelevant average. Charles Leven (1966) indicates the technique of "localization coefficient," frequently used in traditional economic base studies, was discarded by regional scientists at an early stage. In addition to its inherent assumptions of interregional homogeneity with respect to production functions, consumption patterns, and product mix, it also measures only "net" as opposed to "gross" exports. The latter assumption is relevant for multiplier calculations. Thus, by underestimating exports, it overestimates the size of the foreign trade multiplier. Additionally, this technique will produce a biased estimate of exports, which is related to the degree of aggregation employed in industry classification.

Input-output

The input-output approach to the analysis of an economic base provides a very good measurement. This approach in a strict sense does not provide a theory of urban development, but rather a methodology for measuring and examining the structure of the urban economy. It is a modern "export base" theory which has as its foundation the input-output concept originally developed by Wassily Leontief (Moore and Peterson, 1955). It did not receive wide application until the advent of the computer which allowed manipulation of large compilations of various data. The input-output technique has been applied to economies ranging from the national input-output analysis of the United States in 1964 (based on 1958 data) to small regional studies such as the one made for Boulder, Colorado, in 1965 (Miernyk, 1967).

The basic theoretical concept underlying an input-output analysis is that the total economic activity of an area can be described if one recognizes that expenditures made by one sector of the economy are also receipts for other sectors. The act of spending is not an isolated terminal event. Rather, increases or decreases in the expenditures of firms or households should be considered in their entirety. Also, because there exists an interdependence among individual economic units, attention should be given to the ensuing economic effects of such expenditures. Therefore, the overall change in spending generated by the expansion or contraction of a particular industry could be of major concern to private and public planners.

A dollar spent by one economic unit constitutes receipts to other units that will in turn spend a portion of their revenue, creating receipts, although smaller, for yet another group of units. The extent of change in the revenue stream generated by an initial change in expenditure pursued through a large number of rounds of spending and re-spending can be determined by means of a multiplier. Once the multiplier has been adequately computed, it permits a quantitative evaluation of the total impact upon employment, income, and output resulting from a direct change in the basic component for output of a given sector.

In 1968 Bromley, Blanch and Stoevener used an input-output model to evaluate "Effects of Selected Change in Federal Land Use on a Rural Economy." An input-output model was constructed for Grant County, Oregon, to show the nature and extent of economic interdependence in a rural economy which is

dependent upon several uses of federal lands. Two hypothetical changes in federal land use were simulated to detail the possible impact on the county's businesses and households. The changes were:

1. A 20 percent reduction in the total quantity of federal grazing in the county.

2. A 10 percent increase in the gross output of the lumber sector.

These direct impacts to the basic component was then traced through by use of multipliers to determine the costs to society and benefits that resulted from changes in land and resource use (Bromley, et al., 1968).

Minimum requirements

The minimum requirements approach to the urban economic base is an alternative procedure for understanding the urban employment structure. The method yields a quantitative statement which closely approximates the minimum percentage of a labor force required in various sectors of its economy to maintain the existence of an urban area. The employment in an urban area which is greater than this minimum requirement is called excess employment. The minimum requirement closely approximates the service or internal needs of a city. The excess employment approximates the export or basic employment. One of the interesting aspects of minimum requirements is the variation in relation to the size of the city. This is consistent with theory, since the larger the region, the larger the number of specialities that can be supported and the more self-contained the region can be.

The main virtue of the method is that it provides a basis for comparing regions in consistent and meaningful ways.

For individual regions it enables one to calculate the gross export and local components by industry.

The practical value of the method derives from the fact that it facilitates base studies, especially when combined with other data and judgments. Finding the basic or export components of a city does not, of course, enable one to predict with assurance the future growth of a city nor the impact of an addition to basic or export activity. In the former case it has always been recognized that the prospects for the basic activities must be predicted independently on the basis of other knowledge. Isolating these activities, however, is a highly desirable first step. In the second case, we cannot assume a constant multiplier from impact of changes in export because the multiplier may vary with the regional industry mix, although most sectors, such as trade and services, can be approximated over the long run (Ullman, Dacey, and Brodsley, 1969).

Multiplier Concepts

Kahn (1931) is usually credited with the development of the consumption multiplier as we know it now. Following his work, Keynes (1936) made the multiplier concept a fundamental element in his theory of consumption-investment and national income. The basic idea is that the effect of a change in a component of national income does not end with the first round, or direct effect, but will have a multiplicative effect upon total national income. With

an increase in investment, other factors are called into production. When a factor is purchased, the purchase price becomes income to the person selling it and the product and income sides are equal when added up. The receivers of income will save a proportion of their income and spend a portion. This process will continue until the amount saved is equal to the amount invested. At this time an equilibrium level will be reached (Long, 1967).

The consumption multiplier is basically derived from two assumptions:

1. National income made up of consumption and investment and expressed as

$$Y = C + I. \tag{1}$$

2. Consumption as a function of income

$$C = a + bY, \tag{2}$$

where a = a constant, b = slope of consumption function or the proportion of additional income which will be consumed, and Y = income.

From these two equations we obtain the third equation

$$Y = \frac{1}{1 - b} (a + I). \tag{3}$$

This solution describes the equilibrium level of income that would be expected if a, b and I are known. With a change in investment, ΔI, the resulting change in income, ΔY, is calculated as follows. Starting from equation 3 and adding ΔY to the left side and ΔI to the right gives equation 4.

$$Y = \frac{1}{1 - b} \text{ (I)}. \tag{4}$$

This equation shows the ratio between increased investment and increases in income which depend on b, the marginal propensity to consume. This ratio is the familiar multiplier and is often given the notation k. From equation 4 it can be seen that

$$k = \frac{1}{1 - b}. \tag{5}$$

The higher the marginal propensity to consume b, the larger is the multiplier. The system can be extended to include other components, especially imports, taxes, etc.

Leontief (Long, 1966) first developed an interindustry approach to multipliers. Since then many national and regional sector multiplier studies have been completed. Much of the theoretical work has been done by such distinguished economists as Isard, Chenery and Leontief (Long, 1966). Other studies by Heady, Peterson, Schnittker and Carter were some of the first to emphasize agriculture (Long, 1967).

Applications

This section deals with the application of the multiplier concepts to the various approaches previously outlined to the analysis of the economic base.

The input-output model is a system of linear equations describing intersectoral flow of goods and services. The first step is to construct a flow table in which the output of each sector is allocated to each other sector that uses

this output. Physical unit can be used, but the usual procedure is to convert all flows to monetary terms. When this is completed a complete accounting of the flows of goods and services is obtained. Usually an "open" model is assumed, meaning that certain final use sectors such as consumption, government, etc., are considered autonomous to the model. This matrix is called the transactions matrix; each row tells how much that particular sector sells to each other sector, including itself. Each column entry tells us how much that particular sector buys from each sector.

The transactions matrix can be represented mathematically as follows:

$$X_1 = X_{11} + X_{12} + \ldots + X_{ij} \ldots X_{1n} + Y_1$$

$$X = X_{n1} + X_{n2} + \ldots + X_{nj} \ldots X_{nn} + Y_n \qquad (6)$$

where i, j = 1, 2, 3 . . . n

X_j = output of sector i,

X_{ij} = amount of output of sector i purchased by j,

Y_i = final demand for goods of sector i.

The next step of the model is to convert this matrix to technical coefficients, usually called the coefficients matrix. This is done by simply dividing the total output of each sector by each input to that sector. It can be written as $X_{ij} = a_{ij}X_j$ in which a_{ij} is a constant, X_{ij} is the amount of output of sector i purchased by sector j, and X_j is the output of sector j. The technical coefficient a_{ij} is derived by the ratio $\frac{X_{ij}}{X_2}$ or $a_{ij} = \frac{X_{ij}}{X_j}$.

From this matrix the direct dependence of each sector on any other sector is given. The next step is to derive the interdependence coefficients, which show both direct and indirect dependence. The interdependence coefficients are the inverse of the difference between an identity matrix and the coefficients matrix. A mathematical statement is

$$X_1 - a_{11}X_2 - a_{12}X_2 \cdot \cdot \cdot \cdot a_{1j}X_j \cdot \cdot \cdot \cdot a_{1n}X_n = Y_1$$

$$X_n - a_{n1}X_1 - a_{n2}X_2 \cdot \cdot \cdot \cdot a_{nj}X_j \cdot \cdot \cdot \cdot a_{nn}X_n = Y_n. \qquad (7)$$

In matric notation:

$$X - AX = Y,$$

$$X(I - A) = Y,$$

$$X = (I - A)^{-1}Y,$$

where X is a lxn column vector of outputs, A is a matrix of technical coefficients, Y is a lxn column vector of final demand. The system of equations then becomes

$$X_1 = A_{11}Y_1 + A_{12}Y_2 + \cdot \cdot \cdot \cdot + A_{1j}Y_j + \cdot \cdot \cdot + A_{1n}Y_n$$

$$X_n = A_{n1}Y_1 + A_{n2}Y_2 + \cdot \cdot \cdot \cdot + A_{nj}Y_j + \cdot \cdot \cdot + A_{nn}Y_n. \qquad (8)$$

Each interdependence coefficient (C_{ij}) tells us the total receipts (total requirements) to (from) sector i per unit change in final demand to sector j.

By summing the interdependence coefficients by column, we derive the sector multiplier. The normal assumption of linearity, constant trade coefficients, and lack of aggregation bias are made.

Economic base studies divide the economic activity of an area into two segments:

1. That serving markets outside the area.
2. That serving local area markets.

A causal relationship is implicit in this division of economic activity. Exports are considered the prime mover of the local economy, and employment serving these markets thus considered as "basic" employment. Employment serving local markets is considered as "non-basic" or service.

Once total economic activity of a region has been classified as basic and non-basic, it is a simple matter to compute a multiplier effect. That is, we would like to know how much non-basic employment will be created by an increase in basic employment. The simplest assumption is that the basic/non-basic ratio will remain about constant over the long run. On this assumption, the multiplier is computed simply as the total employment in both basic and service activity divided by total basic activity. Or, to give it a more sophisticated form, the change in total employment is equal to the exogenous increase in basic employment multiplied by 1, divided by 1 minus non-basic employment. In equation form

$$T = B \frac{1}{1 - \frac{NB}{T}}. \tag{9}$$

The economic base approach can be extended to reflect more interrelationships in the structure of the economy. By breaking down the total economy into various sectors, a more detailed examination of the economy is possible.

A pertinent question in regional analysis concerns regional delineation. Some argue that the metropolitan centered areas are the only meaningful areas. Others argue for multi-county and multi-state regions. And still others argue for small community areas as meaningful regions. Multiplier analysis has been applied to areas as large as entire nations and as small as sub-county areas. Since multipliers depend heavily on leakages from the area under study, it seems that the area should at least contain a trade center. Theoretically, one could analyze as small an area as he wishes, but applying inter-industry techniques to extremely small areas seems a bit like engaging the best architectural design and construction skills to build an outhouse.

Area Delineation

The two most widely used units for area economic analysis are the county and the Standard Metropolitan Statistical Area (SMSA). The county is now less than optimal as a real governmental unit. A half century ago when the present county organization was developed, they were in a sense functional economic areas. In numerous states the county was defined so that any resident could travel by horse and buggy, at a rate of about five miles per hour, to the county seat and return within the space of one day. During this time, many of the small towns outside the central city served as retail trade and service centers for the dispersed county population.

Widespread use of the automobile and other modern transportation systems has rendered the original county concept meaningless in the sense of being a regional economy. Rather than traveling a limit of five or ten miles for retail goods and services and perhaps 30 miles for major junkets to the central city, the citizen of today who travels at a rate upward of 60 miles per hour has broadened his commuting and shopping range by a factor of five or six. The integrated economic area is no longer one county, but typically several counties centered on a center for its economic organization.

The SMSA concept was articulated in 1940 " . . . to provide a standard area composed of a large city and its closely integrated surrounding area which can be used by government agencies for the purpose of data gathering, analysis, and presentation" (Leven, 1966; Lewis, 1969b, p. 2). To qualify as a SMSA, a county must meet three criteria:

1. Population--the central city must have 50,000 or more inhabitants.

2. Metropolitan character--at least 75 percent of the labor force of the county must be of non-agricultural character, and must have 50 percent or more of its population living in contiguous minor civil division with a density of at least 150 persons per square mile.

3. Integration--a county is regarded as integrated with the county containing the central city of either (a) 15 percent of the workers living in the county work in the county containing the central city, or (b) 25 percent of those working in the county containing the central city of the area.

The definition is fraught with several difficulties. First, as Fox (1969) pointed out, in many areas of the country there are many cities of less than

50,000 serving as foci for a multi-county region. Secondly, an urban area should be appropriately defined as one of a higher degree of systematic interaction among the residents. Population density and non-agricultural labor force characteristics should have little to do with urban area definition in a county characterized by an unusually high degree of mobility. Finally, the SMSA system, including only a small part of the population, leaves millions of people in statistical anonymity.

The functional economic area has been proposed as an alternative. The concept of functional economic area (FEA) was first formulated and demonstrated for non-metropolitan regions. Fox (1966) argues that a highly integrated labor market area in the short run consisting of several counties which would provide a meaningful set of regional planning areas for economic development and might be used for more rational and efficient political reorganization and consolidation.

The FEA concept attempts to specify delineation of the labor market areas of central cities by defining around them a set of small towns, villages and farms which comprise the area of active commuting to the central city.

> Regional economists should have no difficulty with this projective transformation of the structures of a city into the structure of a multi-county area . . . . To me, it seems useful to regard an FEA as a city spatially extended to accommodate a low-density pattern of land use and residential location over the bulk of its area. A further implication is that agriculture, despite its space-filling and eye-catching qualities, is simply another export industry and source of employment from the standpoint of an FEA classification scheme. (Fox, 1963, p. 6)

The Center for Urban Studies at the University of Chicago is responsible for the actual definition of FEA's across the United States. The Center classified urban areas into " . . . a hierarchy of urban, metropolitan, and consolidated areas used criteria of size and of linkages between places of work, place of residence, and places of shopping" (Long, 1966, p. 4). The FEA delineation was based on commuting patterns and the hierarchies of central places or training centers.

Summary

In evaluating selected impacts due to changing federal grazing policy, analyzing the changes in the economic base of an area yielded a quantified measure of the magnitude of the resulting impacts. The analysis of a change in the economic base is meaningful only within a relevant regional unit. This area needs to be relatively closed with respect to residentiary activity. For this reason, the concept of functional economic areas, as reviewed earlier, was used for this study.

With a real context defined, the multiplier concept was developed using the minimum requirements technique in each demand area. This allowed the magnitude of the impacts to be measured within each demand area. The multiplier impact included the direct, indirect, and induced effects of federal grazing policy changes. The magnitude of these impacts can be found in each area by use of the multiplier concept applied to the minimum requirements technique. The employment impacts can be traced to a particular demand area.

CONCEPTS AND PROCEDURES USED IN THIS STUDY

Hypothesis

The hypothesis tested was that changes in federal land policy will have significant effects on the economies of functional demand areas in Utah.[1] Land policies dealing directly with the grazing problem were tested and analyzed. Since the forage supply derived from grazing was used as an input factor in determining the income of the ranching sector, it was necessary to express evidence of changes in federal land policy in monetary terms. This monetary value in turn was converted to a common employment denominator.

Changes in Federal Land Policy to be Tested

In 1966 the Bureau of Land Management, the Forest Service, and the Statistical Reporting Service conducted a fee study. The purpose of this study was to determine a value for the publicly administered forage supply that would be more closely related to market values.

In 1970, Walter I. Hickel, Secretary of the Interior, announced that fees will be established by the Secretary in nine equal annual increments, effective with the fee year beginning March 1, 1971, to attain the fair market value of range forage at the 1979 fee year.[2] Fair market value is that value

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[1] In this study functional demand areas are taken to be equivalent to FEA's.

[2] Fee change initiated in 1969.

established by the Western Livestock Grazing Survey of 1966 or as determined by a similar study which may be conducted periodically to update the fee base, if deemed necessary. Annual adjustments may also be made for any of the 1970-1979 fee years, and thereafter, to reflect current market values.

For the Bureau of Land Management (BLM), this will entail a $ .90 increase per AUM, since the deemed market value is $1.23 per AUM, and current fees are $ .33 per AUM.

The Forest Service is also increasing the fee per AUM on the federal lands they administer. The increase to a deemed market value is the same as for the BLM, $1.23 per AUM. The current fee change per AUM differs on the Forest Service Grazing, depending upon which forest provides the forage supply.

The actual changes in Federal Land Policy to be evaluated are threefold. These changes are:

1. The impact due to the increase in the price per AUM harvested.

2. A policy dealing with the improvement of the forage supply by 30 percent.

3. The reduction of grazing permitted by 50 percent due to institutional constraints.

Production functions can be used to portray the grazing policy changes. The first case is the fee change, as shown in Figure 1, which increases the fee charged per AUM. The fee change would increase the marginal cost at the forage supply from MC_1 to MC_2. This fee increase would tend to increase the cost of AUM's harvested on federal ranges to the ranching sector. This would require less inputs, from B to A, and consequently less output, D to C.

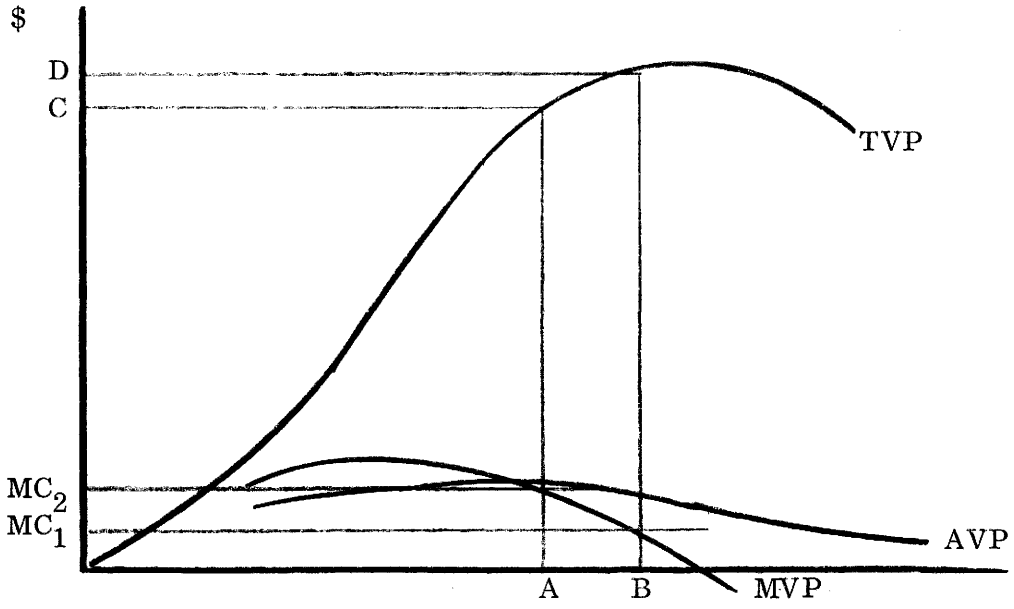

Figure 1. Fee change.

A policy dealing with the improvement of the forage supply, as shown in Figure 2, would tend to increase the marginal value product of AUM's harvested. This would allow for larger operation in the ranching sector.

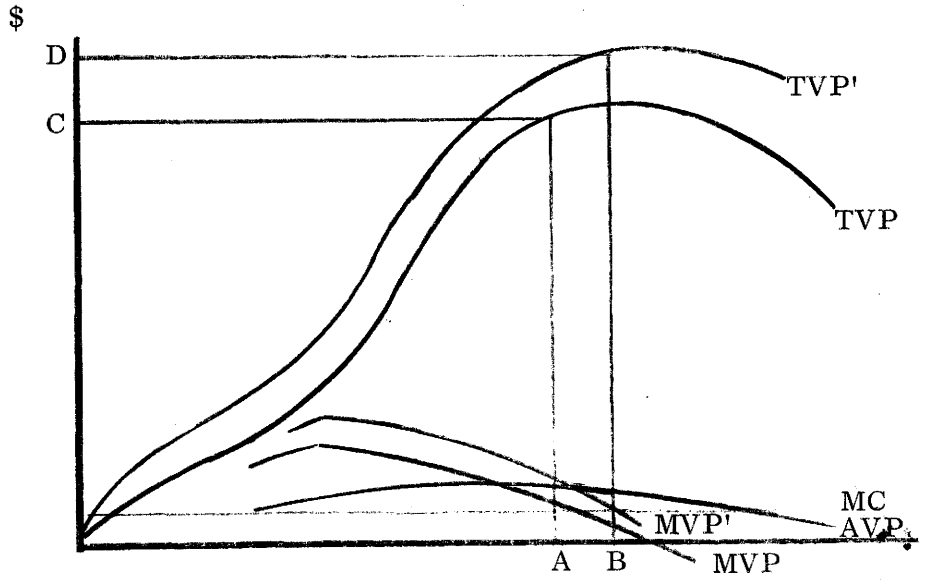

Figure 2. Productivity change.

The marginal value product shifting to the right and crossing the marginal cost line to the right of the original crossing point, from A to B, would cause a higher output, from C to D. The total value product and average value product curves are shifting upward and to the right also.

The third policy change is a reduction in grazing, as shown in Figure 3. This would increase the cost of AUM's harvested, and the ranching operations could decrease in size, possibly to the point of moving the rancher into stage I where he would cease to operate, shown by point C.

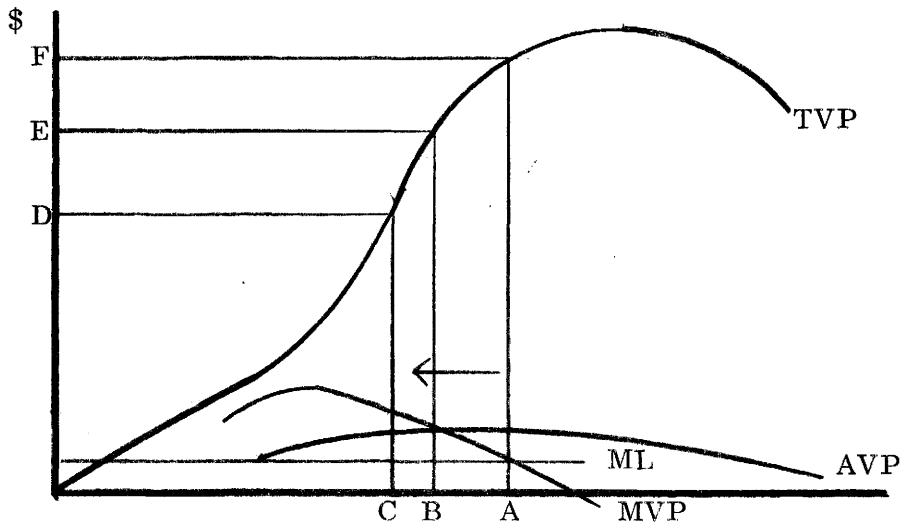

Figure 3. Reduction in grazing

The shift would be along the marginal value product line, the MVP increasing as reduction of grazing increases; for example, from points A to B to C.

Areal Concept

Areal units utilized in this analysis included functional demand areas, BLM districts, and national forests. Demand areas were assumed to provide the minimal bundle of goods and services which ranchers demand. BLM districts and national forests provide the relevant forage supply areas.

Multi-county regions

Impact studies can be carried out much more effectively if the nature of the multi-county regions (functional demand areas) are recognized and their potential achieved. Each demand area is a relatively self-contained labor market in the short run. Also, each area is a reasonably self-contained economic entity which makes the demand areas, although adjacent in physical location, relatively independent from one another in terms of labor markets and economic activity. Typical areas would provide essentially the same range of goods and services to people living within their boundaries. For the stated reasons each demand area can be considered homogeneous to each other area. Attempts to approximate the economic magnitudes of such areas using data from the real world may give less than perfect results, since numerous physical boundaries to transport exist, and whole county data used in their approximation is quite granular.

The demand areas lend themselves to impact studies because of the fact that they are reasonably self-contained. The effects of a change in federal policy were manifested in a combination of direct, indirect, and induced effects

within the self-contained areas. Further implications of these self-contained areas were that the magnitudes of the selected impacts could be measured in meaningful ways.

It is readily apparent to those who study Utah's governmental structure that the arbitrary governmental boundaries of city, county, and state which were established over 50 years ago do not fit the patterns of human interaction, activity, and residence currently dominating society. Individuals often work in a different county than the one in which they live. City limit boundaries are no longer large enough to hold the residences of those who work within the city, and workers may move into the county or even into adjacent counties. Likewise, activity patterns in sparsely populated areas have changed.

Services and facilities have diminished in rural areas in response to a declining rural population, reflecting high rates of technical advance and resource substitution in agriculture. Growth of spacially compact industries in cities resulted in population concentration in the larger cities. Not only have the services diminished in rural areas, but in many cases new types of services have simply not been extended into rural areas to the same degree that they are available in the city. Rural dwellers are expected to come to the service facilities, rather than having a complete range of services available in a great many outlying communities.

As larger businesses located in the metropolitan areas expand their market to serve the state, they strive for the greatest efficiency in administering

statewide services. As a result, traditional county boundaries are largely ignored since administrative subdivisions only coincidentally follow county lines. This is also true with federal and state governmental bodies and services.

Utah is not unique in this respect. Contemporary literature indicates that most states are experiencing or have experienced similar de facto structural changes. Increased mobility, movement to the cities, rapid transportation facilities, new and larger business organizations, and the increase in federal government activity have resulted in changed locational patterns.

As indicated, business organizations, civic and social organizations, and the state and federal government organizations find it beneficial to ignore boundary lines at times. Nevertheless, city and county boundaries persist, and government agencies in particular, find that they must deal with local units.

In 1970 a suggested delineation of Utah into multi-county areas (functional demand areas) was made by Sherman Fitzgerald in cooperation with the State Planning Coordinators Office in Utah (Fitzgerald, 1970).

Fitzgerald gave consideration to many of the factors cited above. In delineating the multi-county regions, Fitzgerald recognized three basic considerations:

1. Analysis of geographic and population factors.
2. Analysis of selected economic factors.
3. Analysis of organizational response structures in the state.

This delineation of Utah into multi-county regions provided the functional demand areas used in this paper. Each region was taken as given by the work of Fitzgerald (1970). A listing of the eight areas and a rationale for their delineation are listed in Appendix B. Further, it provides a picture of the study area and the units upon which impacts from federal grazing policy changes were evaluated. Figure 4 shows the physical area and counties encompassed in each of the eight areas.

Forage supply regions

Bureau of Land Management districts. The Bureau of Land Management in Utah consists of eight district offices and one state office in Salt Lake City. The district offices are located in Cedar City (with area office in St. George), Fillmore, Kanab (with area office in Escalante), Monticello (with area office in Moab), Price, Richfield, Salt Lake (with area offices in Brigham and Randolph), and in Vernal, Utah.

In Utah the Bureau of Land Management has exclusive jurisdiction of approximately 22,752,224 acres.

National forests. Forest Region 4 encompasses Utah as well as parts of other states. There are 12 forests on which grazing is allowed in Utah and each forest is broken down into ranger districts for purposes of planning and control. These forests are: Ashley, Bridge, Cache, Caribou, Challis, Dixie, Fishlake, Manti-LaSal, Sawtooth, Targhee, Uintah, and Wasatch.

Figure 5 shows the federal lands in the State of Utah. It can be seen that the BLM administers the larger proportion of Utah federal lands.

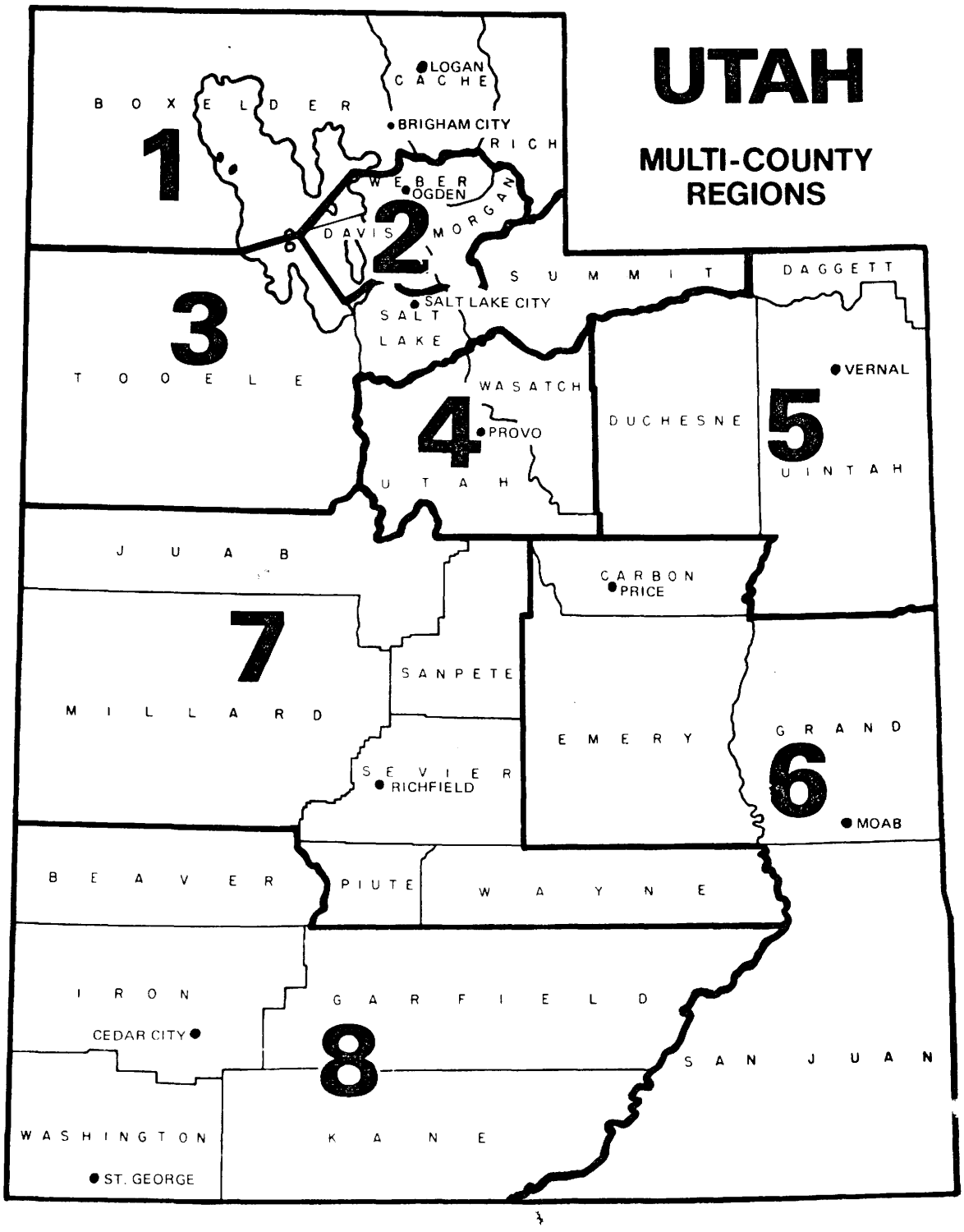

Figure 4. Multi-county regions in Utah.

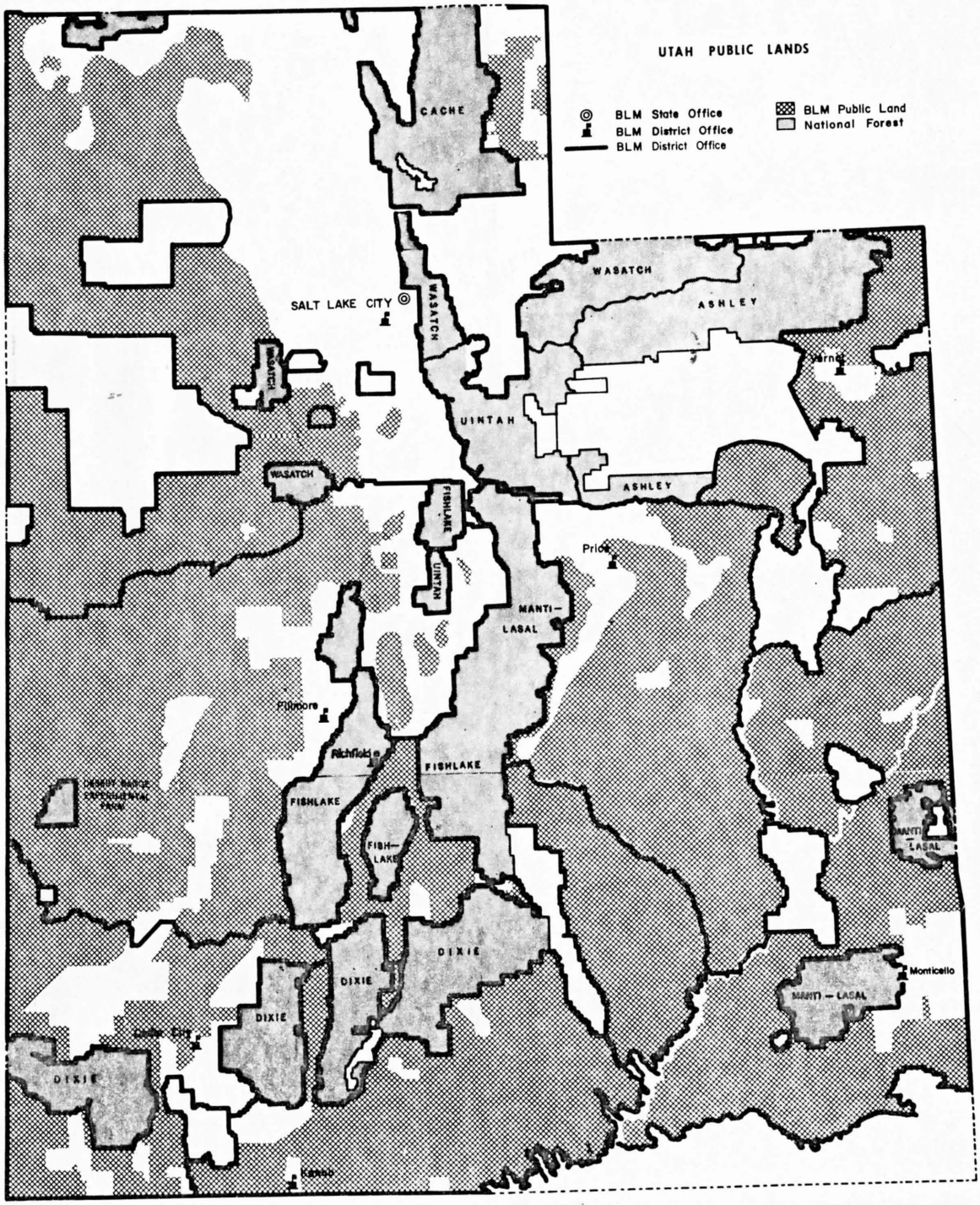

Figure 5. Federal lands in Utah.

Areal Employment and Income Multipliers

Two economic base type multipliers were calculated to be used in estimating income and employment impacts for functional demand areas. The first was based on a minimum required employment while the second was based on income by industry source. Income employment ratios were calculated to facilitate comparison of the results obtained from both multipliers.

Employment multipliers

Using the minimum requirements technique, employment multipliers were derived for each demand area. Aggregation of employment by sector from ten sectors, as given by ESC, into seven consistent sectors with minimum requirements facilitated the estimation of a base multiplier. The minimum requirements technique facilitates comparison of the actual employment in each sector with the minimum projected employment requirements. The difference in each sector was calculated as a percentage of the total excess employment--excess employment meaning actual over the minimum requirements. These excess percentages were summed for all seven sectors to obtain a total excess employment percentage for each demand area.

This excess employment percentage was divided into 100 to obtain the employment multiplier for each respective demand area. For example, if the total excess employment percentage for an area were 50 percent, then the employment multiplier would be two, meaning that for every single change in basic employment for that area, the combined employment change in basic and service employment would be double that of the basic change.

Income multipliers

Income multipliers were calculated in the following manner. Following the classification of sectors into basic and service as used by Fox and Kumar (1966), a measure of each was obtained. Appendix D indicates the classification of industries used for this study. This appendix also indicates which industries are basic and which are service. The income multipliers were obtained by division of the basic income by demand area into the total income of that area. This procedure gave income multipliers for each of the demand areas.

Monetary Change to Demand Areas

The significant difference between this study and other impact studies was the manner in which the loss or gain in income and employment was allocated to different demand areas. The primary feature used was the placing of permittees into demand areas consistent with their place of residence. Thus, it mattered not where he obtained the forage supply he was allowed. The important fact was where the rancher obtained goods and services.

In ascertaining the dollar value, a multiplication of each permittee's AUM's and change in cost of the forage supply gave the dollars lost or gained due to a change in federal grazing policy. The dollars lost or gained were then summed by demand area. In this manner the cost of a change in forage supply was traced by its users to the demand areas.

A separation was maintained on the source of all forage supply. This was necessary to estimate the costs of different grazing changes. The fee change

involved different amounts on different forests. With reduction in grazing and productivity changes, the cost of replacement differed among areas.

In determining the dollars lost or gained from the three grazing changes, the method as outlined previously was used. The fee change or replacement costs multiplied by the AUM's involved were traced to each respective demand area.

Adaptations of Income Multipliers

Final payments to households and capital consumption as given by Bradley (1968) were used in this study to approximate control totals on state income by industry. These incomes were aggregated into the seven sectors used. At this point adjustments were made for differences in productivity of labor among demand areas. The productivity adjustments were made on the agricultural sector and the non-agricultural sectors.

Productivity indexes for the two sectors, agriculture and non-agriculture, were calculated from data compiled for the Utah State Preliminary Development Plan (1969). In the Development Plan report personal income was given by demand areas and by industry source for 1965. Using this data the agricultural productivity index was calculated by the following formula:

$$\frac{\text{Area agriculture income} \,/\, \text{Area agriculture employment}}{\text{State agriculture income} \,/\, \text{State agriculture employment}}$$

This gave the productivity indexes for each demand area relative to the state average.

The non-agricultural productivity indexes were calculated in a similar manner.

$$\frac{\text{Area non-agriculture income}}{\text{State non-agriculture income}} \Big/ \frac{\text{Area employment}}{\text{State employment}}$$

This gave productivity indexes for each demand area for the non-agricultural sectors.

The incomes from the Bradley study (Bradley, 1968) were allocated to the demand areas by the percentage of total state employment contained within each demand area. Once the income was allocated to demand areas, they were adjusted by the respective productivity indexes to provide a closer approximation of areas of personal income.

To facilitate the comparison of the income multipliers with employment multipliers, income changes were converted to a common base, the change in number of full time jobs.

The income change was initial income change to the ranching sector. The combined direct, indirect, and induced income changes were obtained by multiplying the initial income change by the income multiplier.

The adjusted income in $1,000 increments for differences in productivity were summed by demand area and divided into total employment for the area. This gave an estimate of employment per $1,000 income (E/I ratio).

Employment changes were calculated by multiplying the E/I ratios by the initial change in income to the ranching sector and the initial income change in $1,000 increments. This gave the initial employment loss or gain associated with changes in federal grazing policy. The combined direct, indirect, and induced employment loss or gain was obtained by multiplying the initial change in employment by the employment multiplier for each demand area.

Employment Data

The employment statistics for Utah in the years involved in the study were obtained from the Utah Department of Employment Security. They compiled the employment statistics into a ten-sector breakdown. Further aggregation to seven sectors was necessary because of disclosure problems involved for sectors in some counties.

County employment statistics were combined by sector for each multi-county area as a prelude to an application of the technique of minimum requirements. Through this application, employment multipliers for each functional demand area were derived.

Forage Supply

The statistics of the forage supply administered by the Forest Service were obtained from the grazing information as compiled in the 1966 grazing fee study. Forest Service Region 4 encompasses all forage supply being harvested in Utah. The place of residence of the permittee holder and the total

number of AUM's being used by him were obtained from the 1966 fee study. This facilitated the classification of permittees by county and subsequently by functional demand areas.

The Forest Service does not have a uniform fee pricing system. The average fee charged per AUM varies between forests. Also, the cost involved in replacing a forage supply on private lands differs from area to area. Therefore it was necessary to obtain a listing of permittees to trace forest specific policy changes to each demand area.

The number of AUM's harvested in each forest multiplied by the average fee differential for that forest provides an estimate of the dollar value lost or gained to each demand area. The place of residence of the permittee holders was established and the dollar value lost or gained was allocated to the respective demand area. Cost of replacing a forage supply for each respective forest multiplied by the number of AUM's lost or gained on that forest were summed by permittee's residence to determine the dollar impact of policy changes on a particular functional demand area.

The eight district Bureau of Land Management offices and five area offices were visited to obtain grazing statistics. The case files of permittees were reviewed to obtain the place of residence and the active and non-use AUM's for each permittee holder. These statistics were compiled by county and by demand areas. Detail on the location and AUM's by district were maintained for the purpose of calculating differences in costs of replacement forage.

The Bureau of Land Management has a standard fee per AUM so they were the same throughout the state. The number of AUM's multiplied by the fee per AUM gave a dollar estimate of the change in the ranching sectors income for the respective functional demand area due to land policy changes.

The number of AUM's held by residents within each demand area were identified by district of use. It was essential to retain this detail to ascertain the costs involved in obtaining replacement forage. This was necessary because the costs of replacement forage varied from district to district. By multiplying the cost of replacement forage times AUM's gained or lost it was possible to estimate the cost allocated to each demand area.

Cost of Replacement Forage

Dr. Nielsen in 1970 determined the cost of replacement forage on Forest Service ranges (Nielsen and Williams, 1970). These data were used in the current study for both replacement on forests and BLM districts. It was judged to be applicable to BLM districts as well as forests, as originally designed, because of the close proximity of BLM lands and national forests. Further, it was assumed that replacement costs would be closely related.

Replacement costs varied from area to area, depending upon supply and demand conditions. The cost of replacement multiplied by the number of AUM's provided a reasonably good approximation of the cost involved in the replacement of a forage supply lost to the ranching sector through a reduction in grazing on federal lands. Further, it provided an estimate of the ranching

sector from changes in the productivity of the federal lands, which resulted in AUM usage. Such a gain was taken to mean the gain in receiving less expensive forage over that which would have been previously received from a private range.

ANALYSIS AND RESULTS

This section includes a listing of the analysis and results obtained from the minimum requirements technique[3] and the analysis of changing incomes in the ranching sector within the context of the economies of functional demand areas.

Minimum Requirements

A linear regression equation of the minimum employment requirements associated with population of a functional demand area for all seven sectors of their economy has the following form:

$$Y = a + b \log X \tag{10}$$

where Y is the minimum employment requirement or percent, X is the log of the population of the functional demand area, and a and b are parameters. The population of Area I, for example, was 73,400 in 1963. The log of the population is 4.8657. Accordingly, for Area I the estimating equation was

$$Y = a + b\ (4.8657). \tag{11}$$

The parameters, a and b, for the seven sectors of each functional demand area were shown in Table 1. The best estimate of the total minimum employment requirement was given by the equation

[3]For a more complete discussion of this technique see Ullman, Dacey, and Brodsley (1969).

$$Y = -11.83506 + 11.105201 \log X. \quad (12)$$

Table 1. Parameters for use by minimum requirements[a]

Sectors of economy		a	b
Agriculture		-0.73888	0.28766
Mining		Not computed, 0.0%	
Construction		-1.95250	1.12851
Manufacturing		-9.13086	2.83568
Transporting, Communications		-0.43408	0.87031
Trade	Wholesale	-1.45025	0.63809
	Retail	8.22845	0.97674
Services and Misc.			
	Finance, Insurance	-0.35947	0.43173
	Business, Repair Service	-0.43254	0.41521
	Personal Services	0.65422	0.56129
	Entertainment	-0.39717	0.19992
	Professional Services	-2.48673	1.69448
	Public Administration	-1.94562	0.79043

[a] From Ullman, Dacey and Brodsley (1969).

Equation 11 was used to determine the total minimum employment requirement for each of the eight functional demand areas. The minimum requirement percentage by sector was multiplied by the total actual employment of the functional demand area to obtain the actual number of employees needed for minimum requirements to sustain the existence of the region. The latter figures, by sector, are in column 2 of Table 2. Table 2 shows,

Table 2. Estimates of basic minimum components for demand areas, 1963

Activity	Region employment		Min. req. for area size of Region		Excess or export employment (Col. 1 - Col. 2)		
	No.	%	No.	%	No.	% of total employ.	% of total employ.
	(1)		(2)		(3)	(4)	
Region 1							
Agriculture	3600	13.81	172	0.66	3428	13.15	21.43
Mining	109	.42	0	0.00	109	.42	.68
Construction	1161	4.45	923	3.54	238	.91	1.49
Manufacture	7366	28.26	1217	4.67	6149	23.59	38.43
Trans. Comm. Ut.	460	1.76	990	3.80	----	-2.40	-----
Trade	3437	13.19	3813	14.63	----	-1.44	-----
Service & Misc.	9932	38.11	3858	14.80	6074	23.31	37.97
Total	26065	100	10973	42.10	15998	57.54	100
Employment multiplier		1.74					
Region 2							
Agriculture	2130	3.39	497	.79	1633	2.60	4.85
Mining	80	0.13	0	0.00	80	.13	.24
Construction	2974	4.73	2534	4.03	540	.70	1.61
Manufacture	8565	13.62	3709	5.90	4856	7.72	14.43
Trans. Comm. Ut.	4332	6.89	2628	4.18	1704	2.71	5.06
Trade	9425	14.99	9752	15.51	----	-.52	-----
Service & Misc.	35367	56.25	10525	16.74	24842	39.51	73.81
Total	62873	100	29645	47.15	33655	52.85	100
Employment multiplier		1.89					
Region 3							
Agriculture	2400	1.29	1650	.89	750	.40	.82
Mining	6420	3.46	0	0.00	6420	3.46	7.06
Construction	10076	5.44	8194	4.42	1882	1.02	2.07
Manufacture	29473	15.90	12774	6.89	16699	9.01	18.36
Trans. Comm. Ut.	13632	7.35	8306	4.48	5326	2.87	5.85
Trade	41420	22.34	29812	16.08	11608	6.26	12.76
Service & Misc.	81976	44.22	33687	18.17	48289	26.05	53.08
Total	185397	100	94423	50.93	90974	49.07	100
Employment multiplier		2.04					

Table 2. Continued

Activity	Region employment		Min. req. for area size of Region		Excess or export employment (Col. 1 - Col. 2)		
	No.	%	No.	%	No.	% of total employ.	% of total employ.
	(1)		(2)		(3)		(4)
Region 4							
Agriculture	2410	7.02	247	.72	2173	6.30	11.34
Mining	517	1.51	0	0.00	517	1.51	2.70
Construction	1443	4.21	1297	3.78	146	.43	.76
Manufacture	7075	20.62	1808	5.27	5267	15.35	27.48
Trans. Comm. Ut.	1177	3.43	1369	3.99	----	-.56	-----
Trade	5221	15.22	5199	15.15	22	.07	.11
Service & Misc.	16470	47.99	5428	15.82	11042	32.17	57.61
Total	34313	100	15348	44.73	19167	55.27	100
Employment multiplier		1.81					
Region 5							
Agriculture	1680	22.60	34	.46	1646	22.14	32.45
Mining	938	12.62	0	0.00	938	12.62	18.50
Construction	456	6.13	196	2.64	260	3.49	5.12
Manufacture	209	2.81	201	2.70	8	.11	.16
Trans. Comm. Ut.	249	3.35	223	3.00	16	.35	.51
Trade	912	12.27	930	12.51	----	-.24	-----
Service & Misc.	2990	40.22	853	11.47	2137	28.75	42.14
Total	7434	100	2437	32.78	5005	68.22	100
Employment multiplier		1.47					
Region 6							
Agriculture	1370	10.35	77	.58	1293	9.77	15.31
Mining	3134	23.69	0	0.00	3134	23.69	37.11
Construction	665	5.03	429	3.24	236	1.79	2.79
Manufacture	295	2.23	519	3.92	----	-1.69	-----
Trans. Comm. Ut.	922	6.97	472	3.57	450	3.40	5.33
Trade	1677	12.67	1904	14.39	----	-1.72	-----
Service & Misc.	5168	39.06	1835	13.87	3333	25.19	39.46
Total	13231	100	5236	39.57	8446	62.15	100
Employment multiplier		1.61					

Table 2. Continued

Activity	Region employment		Min. req. for area size of Region		Excess or export employment (Col. 1 - Col. 2)		
	No.	% (1)	No.	% (2)	No.	% of total employ. (3)	% of total employ. (4)
Region 7							
Agriculture	3820	29.69	73	.57	3747	39.12	43.31
Mining	284	2.21	0	0.00	284	2.21	3.28
Construction	243	1.89	412	3.20	----	-1.31	-----
Manufacture	1445	11.23	490	3.81	955	7.42	11.04
Trans. Comm. Ut.	385	2.99	455	3.54	----	-.55	-----
Trade	1263	9.82	1843	14.32	----	-4.50	-----
Service & Misc.	5426	42.17	1761	13.69	3665	28.48	42.37
Total	12866	100	5034	39.13	8651	60.87	100
Employment multiplier		1.64					
Region 8							
Agriculture	1960	17.46	63	.56	1897	16.90	27.47
Mining	400	3.56	0	0.00	400	3.56	5.79
Construction	520	4.63	351	3.13	169	1.50	2.45
Manufacture	2154	4.04	409	3.64	45	.40	.65
Trans. Comm. Ut.	617	5.50	392	3.49	225	2.01	3.26
Trade	1843	16.42	1596	14.22	247	2.20	3.58
Service & Misc.	5432	48.39	1510	13.45	3922	34.94	56.80
Total	11226	100	4321	38.49	6905	61.51	100
Employment multiplier		1.63					

for each demand area, the minimum employment requirements and the employment requirements and the employment multipliers, such as for Area I the employment multiplier is 1.74. Equation 11 was used to determine the percentage of the total to be allocated to each of the seven sectors in the economy. More precisely, the minimum employment requirement was multiplied by the

coefficients obtained from equation 11 to obtain the minimum employment requirements for each of the seven sectors, as shown in column 2 of Table 2. The number of employees in column 2 of Table 2 was subtracted from the actual number employed in each functional demand area, column 1, to obtain the number of excess or export employment. The latter figures are shown in column 3 of Table 2. The percentage of excess employment was also calculated by dividing the total excess employment into the actual excess or export employment per sector and subtracting this figure from 100, as shown in column 3 of Table 2.

Determination of Variables Used

Employment multiplier

The employment multiplier as set forth by the minimum requirements technique was obtained by the addition of the percentages of excess or export employment, in column 3, Table 2, for the seven sectors and dividing this number into 100. This gave the employment multiplier or, if broken down, the service-basic ratio. For example, in Region 1, the service-basic ratio is .74 to 1.00, and the employment multiplier 1.74. The employment multiplier represents the combined direct, indirect, and induced changes in employment.

Estimates of the basic minimum requirement components and employment multipliers for the eight multi-county regions are shown in Table 2.

The total populations of the eight functional demand areas and the log used are given in Table 3.

Table 3. Demand areas, populations and their logs--1963

Multi-county regions	Populations	Log
1	73,400	4.86570
2	200,500	5.30211
3	447,200	5.65050
4	119,900	5.07882
5	22,000	4.34242
6	40,100	4.60314
7	36,500	4.56229
8	31,900	4.50379

Income multipliers

Income multipliers were calculated in the following manner. Industry estimates of household income and capital consumption from the Bradley study (Bradley, 1968) were aggregated into agriculture and non-agriculture sectors. Allocation of income to the demand areas was based on the percentage of total state employment contained within each area. For example, in Area I the percentage of state employment in the agriculture sector was 18.59 percent. This 18.59 percent of total agriculture income was allocated to Area I. The same procedure was used for each demand area. The non-agriculture income was calculated in a similar manner.

The agriculture income for each demand area was multiplied by the respective agriculture productivity indexes. Non-agriculture incomes were multiplied by the non-agriculture productivity indexes. These adjusted were necessary for estimates of incomes which differed with associated differences in productivity from area to area. The productivity indexes for the agriculture and non-agriculture sectors are shown in Table 4.

Table 4. Productivity indexes and adjusted incomes by demand area--1964

Area	Agriculture			Non-agriculture		
	Income	Index	Adjusted income	Income	Index	Adjusted income
1	14,424,539	1.62	23,367,753	132,334,547	0.84	111,161,022
2	8,535,230	0.46	3,926,206	357,480,248	1.12	400,377,880
3	9,613,773	0.96	9,229,222	1,077,356,590	1.06	1,141,997,996
4	9,652,529	1.05	10,135,155	187,785,279	1.07	199,052,397
5	6,727,313	0.99	6,660,040	33,821,014	0.85	28,747,862
6	5,485,825	0.59	3,236,637	69,804,999	0.91	63,522,549
7	15,301,340	0.49	7,497,657	53,287,760	0.79	42,097,330
8	8,007,598	0.95	7,607,218	54,467,563	0.94	51,199,509

The adjusted incomes were then allocated to basic-service sectors following the classification used by Fox and Kumar (1966). This industry classification scheme is shown in Appendix D. Allocation of incomes was based on the respective percentages of basic-service sectors of the total demand area employment. This was accomplished by summing employment by basic-service sectors and obtaining the respective percentages of total area employment. These percentages were then multiplied by the total adjusted incomes of agriculture and non-agriculture sectors to obtain the income of the basic and service sectors.

The income of the basic sector was divided into total income for each demand area to obtain the income multipliers. The income multipliers are shown in Table 5. These income multipliers ranged from 2.17 to 4.23.

Table 5 lists the income multipliers for each demand area; also the incomes used for calculating the multipliers.

Table 5. Income multipliers for demand areas

Area	Basic income	Total income	Income multipliers
1	$ 59,529,085	$ 134,528,775	2.26
2	95,617,917	404,304,086	4.23
3	322,804,161	1,151,227,218	3.57
4	68,195,241	209,187,552	3.07
5	14,651,780	35,407,902	2.42
6	29,374,052	66,759,186	2.27
7	22,873,218	49,594,987	2.17
8	26,880,565	58,806,727	2.19

Employment-income ratios

Coefficients of employment per $1,000 of income (E/I ratios) were calculated. Total income per demand area was divided by $1,000 to obtain incomes in $1,000 increments by areas. The income in $1,000 increments was divided into total employment for the respective demand area. The E/I ratios are shown in Table 6. The ratio means, for example, that in Area I there are 0.1938 full time jobs per $1,000 of income received in Area I.

Table 6. E/I ratios for demand areas

Area	Employment per $1,000 income
1	.1938
2	.1555
3	.1610
4	.1640
5	.2099
6	.1982
7	.2594
8	.1909

Multiplier comparison

Comparison of the employment and income multipliers was useful. This facilitated a comparison of the imports in terms of employment and income. Both multipliers were compared in employment and income terms. The income multiplier and its effects were consistently larger than the employment multiplier, in income and employment terms. For example, the income multiplier for Area I was 2.26, as shown in Table 5. This income multiplier of 2.26 can be compared with the employment multiplier for Area I of 1.74, as shown in Table 2.

The income multiplier was consistently larger than the employment multiplier due to the method of calculating each multiplier. In aggregating sectors for calculating income multipliers, the aggregation was gross. This contrasts with the minimum requirements approach which allows a finer distinction between basic and service industries. For example, in the calculation of the income based multipliers, construction, trade, service and miscellaneous were assumed engaged solely in residentiary activity while all other sectors were engaged in purely export activity. In contrast, the employment based multiplier, utilizing minimum requirements, permits any industry to produce for both export and residentiary markets.

Cost of replacement forage

If a rancher continues to operate following a reduction in numbers of AUM's he obtains from federal lands, he must locate and utilize replacement forage. Costs are involved in obtaining replacement forage in grazing. The ranching

sector would be forced to locate a forage supply within the private sector. A similar situation exists with changes in productivity on federal ranges. It is assumed that with an increase in productivity on federal ranges, the rancher would be able to obtain this additional forage supply. The gain was measured in terms of replacement costs.

The value in dollars lost or gained to the ranching sector was obtained from the study done in 1970 by Nielsen (Nielsen and Williams, 1970). In this study forage costs per AUM were estimated for private lands adjacent to or closely related to that of federal lands. These costs per AUM are summarized in Tables 7 and 8 for Bureau of Land Management districts and national forests, respectively. The replacement costs ranged from $4.60 to $6.28 on BLM lands and $4.37 to $6.82 on forests.

Table 7. Forage replacement costs per AUM on Bureau of Land Management districts

Bureau of Land Management districts	Cost of replacement forage per AUM
Cedar City	$4.60
Fillmore	4.80
Kanab	4.60
Monticello	5.23
Price	5.23
Richfield	4.70
Salt Lake	5.28
Vernal	6.28

Table 8. Forage replacement costs per AUM on national forests in Forest Region 4

National forest	Cost of replacement forage per AUM
Ashley	$6.82
Boise	4.37
Bridger	6.04
Cache	5.05
Caribou	4.53
Challis	6.11
Dixie	4.60
Fish Lake	4.80
Humboldt	4.44
Manti-LaSal	5.23
Salmon	4.75
Sawtooth	5.14
Targhee	4.58
Uinta	5.81
Wasatch	5.51

Price Changes

On lands administered by the BLM, pricing is uniform. A flat fee per AUM is charged. The stipulated increase fee on this land is $ .90, thus increasing cost $ .33 to $1.23 per AUM. Differential cost affecting each respective demand area was obtained by multiplying the number of actively used AUM's in each demand area by the $ .90 fee increase.

The pricing system on the national forests does not have this consistency since it is variable from one forest to another. Therefore, the average fee cost for each national forest was obtained from the 1970 study by Dr. Nielson (Nielsen and Williams, 1970). The average fee cost per AUM and the difference

which would result if increased to $1.23 per AUM are shown in Table 9. On the Ashley Forest, for example, the average fee per AUM was $0.54, and the difference to the proposed price change was $0.69.

Table 9. Average fee per AUM and differential to proposed fee increase on national forests

National forest	Average fee per AUM	Fee (price) differential
Ashley	$0.54	$0.69
Boise	0.48	0.75
Bridger	0.54	0.69
Cache	0.64	0.59
Caribou	0.64	0.59
Challis	0.48	0.75
Dixie	0.58	0.65
Fish Lake	0.57	0.66
Humboldt	0.46	0.77
Manti-LaSal	0.53	0.70
Salmon	0.42	0.81
Sawtooth	0.57	0.66
Targhee	0.54	0.69
Uinta	0.61	0.62
Wasatch	0.55	0.68

Multiplication of the number of AUM's times the respective difference in the proposed fee from which the forage supply is obtained provided an estimate of the cost of the change in pricing policy to each of the eight demand areas. The change in grazing policy can be expected to either increase or decrease the ranching sector's incomes.

Total AUM's on national forests

The number of AUM's attributed to each functional demand area and the forest from which the forage supply is obtained are shown in Table 10. For Area I the total AUM's is 55,261.

Total AUM's on Bureau of Land Management districts

The number of actively used AUM's on BLM districts is shown in Table 11. These were AUM's placed in demand areas by permittee's residence with a separation keep on the number of AUM's derived from each district. For example, the AUM's on Area I from Fillmore number 18,737.

Implementation of Price Changes

An estimate of the dollar value of impact on each demand area associated with price policy changes on the national forests was obtained in the following manner. AUM's per forest per demand area were multiplied by the price differential associated with the policy change. A similar but somewhat simpler process was used for BLM districts. Districts have a uniform price. Total AUM's per demand area, from Table 11, were multiplied by the $ .90 fee increase. Total dollars lost to each demand area are shown in Table 12, column 1.

Table 12 shows estimated income changes in the ranching sector for each demand area due to changes in federal grazing policy.

Tables 13, 14, and 15 show the employment and income changes due to federal grazing changes. Column 1 in each table shows the initial and

Table 10. Permittee use of AUM's by forest and by demand area

Area	National forest	AUM's on each forest	Total AUM's in area
1	Bridger	734	
	Cache	42,161	
	Caribou	6,323	
	Dixie	32	
	Sawtooth	5,862	
	Uinta	149	
			55,261
2	Ashley	15	
	Boise	66	
	Bridger	254	
	Cache	3,853	
	Caribou	1,796	
	Challis	12	
	Dixie	643	
	Fish Lake	3,410	
	Uinta	3,456	
	Wasatch	790	
			14,295
3	Ashley	3,043	
	Cache	2,207	
	Caribou	490	
	Dixie	2,315	
	Fish Lake	200	
	Manti-LaSal	5,597	
	Targhee	1,554	
	Uinta	15,567	
	Wasatch	24,192	
			55,166
4	Ashley	2,066	
	Dixie	92	
	Fish Lake	446	
	Manti-LaSal	7,321	
	Salmon	79	
	Uinta	65,610	
	Wasatch	1,759	
			77,373

Table 10. Continued

Area	National forest	AUM's on each forest	Total AUM's in area
5	Ashley	56,649	
	Fish Lake	262	
	Manti-LaSal	10,436	
	Targhee	1,636	
	Uinta	5,295	
	Wasatch	684	
			74,962
6	Ashley	3,799	
	Cache	822	
	Caribou	30	
	Fish Lake	1,901	
	Manti-LaSal	69,037	
	Salmon	16,798	
	Uinta	552	
			94,219
7	Dixie	15,189	
	Fish Lake	92,273	
	Humboldt	177	
	Manti-LaSal	69,192	
	Unita	15,114	
	Wasatch	2,153	
			194,102
8	Boise	30	
	Dixie	81,540	
	Fish Lake	7,321	
	Manti-LaSal	56	
			88,947

Table 11. Permittee use of AUM's by BLM districts and by demand area

Area	District	AUM's on each district	Total AUM's in area
1	Fillmore	18,737	
	Salt Lake	43,649	
			62,386
2	Fillmore	8,360	
	Richfield	48	
	Salt Lake	17,530	
	Vernal	733	
			26,814
3	Fillmore	41,355	
	Kanab	2,153	
	Richfield	1,111	
	Salt Lake	116,875	
	Vernal	7,642	
			169,467
4	Fillmore	30,177	
	Monticello	735	
	Price	461	
	Salt Lake	32,164	
	Vernal	4,266	
			67,503
5	Price	2,620	
	Vernal	71,141	
			73,761
6	Monticello	100,353	
	Price	70,881	
	Richfield	337	
			161,610
7	Cedar	140	
	Fillmore	174,118	
	Kanab	5,931	
	Price	105	
	Richfield	31,312	
	Salt Lake	8,404	
			242,871

Table 11. Continued

Area	District	AUM's on each district	Total AUM's in area
8	Cedar	52,173	
	Fillmore	17,970	
	Kanab	66,941	
	Richfield	3,805	
			140,889

Table 12. Dollars lost or gained by the ranching sector in each demand area

Area	Differential fee cost to $1.23 (1)	Reduction in forage harvested by 50% (2)	Increase in productivity by 30% (3)
1	$ 88,435	$298,178	$181,704
2	33,958	104,941	62,006
3	188,879	200,850	412,646
4	109,595	348,115	238,869
5	117,828	501,101	244,843
6	172,947	724,981	379,976
7	348,765	921,480	642,469
8	184,695	508,326	303,910

Table 13. Employment and income changes due to fee change[a]

Area	Employment based multiplier[b] (1)			Income based multiplier (2)		
	Employ. change		Income change	Income change		Employ. change
	Initial	Total	Total	Initial	Total	Total
1	17.14	29.82	$153,877	$ 88,435	$199,863	38.73
2	5.28	9.98	64,181	33,958	143,219	22.27
3	30.41	62.04	385,313	188,879	674,298	108.56
4	17.97	32.53	198,367	109,595	336,457	55.18
5	24.73	36.35	173,207	117,828	285,144	59.85
6	34.28	55.19	278,445	172,947	392,590	77.81
7	90.47	148.37	571,946	348,765	756,820	196.32
8	54.95	89.57	301,053	184,695	404,482	77.22

[a]Losses.
[b]Employment in number of full time jobs.

Table 14. Employment and income changes due to reduction in forage harvested by 50 percent[a]

Area	Employment based multiplier[b] (1)			Income based multiplier (2)		
	Employ. change		Income change	Income change		Employ. change
	Initial	Total	Total	Initial	Total	Total
1	57.79	100.56	$ 518,830	$298,178	$ 673,882	130.60
2	16.32	30.85	200,228	104,941	443,900	69.03
3	32.34	65.97	409.734	200,850	717,035	115.44
4	57.09	103.33	630,088	348,115	1,068,713	175.27
5	105.18	154.61	742,504	501,101	1,212,664	254.54
6	143.69	231.34	116,722	724,981	1,645,707	326.18
7	239.03	392.01	1,511,227	921,480	1,999,612	518.70
8	97.04	158.18	826,571	508,326	1,113,234	212.52

[a]Losses
[b]Employment in number of full time jobs.

Table 15. Employment and income changes due to increase of productivity by 30 percent[a]

Area	Employment based multiplier[b] (1) Employ. change Initial	Employ. change Total	Income change Total	Income based multiplier (2) Income change Initial	Income change Total	Employ. change Total
1	35.21	61.27	$ 316,168	$181,704	$ 636,651	123.38
2	9.64	18.22	117,191	62,006	262,285	40.79
3	66.44	135.54	124,980	412,646	1,473,146	237.18
4	39.17	70.90	432,353	238,869	733,328	120.27
5	51.39	75.54	359,919	244,843	592,520	124.37
6	75.31	121.15	611,761	379,976	862,546	163.82
7	166.66	273.32	1,053,649	642,469	1,394,158	361.64
8	58.02	94.57	498,633	303,910	665,563	127.06

[a]Gains.
[b]Employment in number of full time jobs.

multiplier effect on employment. Column 2 shows the initial and multiplier income effects. Column 3 is the income multiplier effect converted into an employment base. This was done to facilitate comparison of the employment and income multiplier effects.

Employment and income effects on demand areas

The initial loss in employment is shown in Table 13. This initial loss is attributed to the direct effects of a decrease in the ranching sector's income as shown in Table 12, column 1, for each of the eight demand areas. The multiplier loss is also shown in Table 13, column 1, for each of the eight demand areas. The multiplier loss encompasses the direct, indirect, and induced effects in the economy due to the decrease in the ranching sector's income.

The combined direct, indirect, and induced effects resulted in a loss of employment ranging from 5.28 jobs in Demand Area 2 to 90.47 jobs in Demand Area 7.

The initial loss of employment due to a pricing change was calculated in the following manner. The E/I ratio, as shown in Table 6, was multiplied by the dollars lost, in $1,000 increments as shown in Table 12, column 1, to obtain the number of full time jobs lost. Using this procedure, the eight demand areas were analyzed.

The employment multiplier loss effect was calculated as a product of the initial employment loss, as shown in Table 13, column 1. The initial employment loss was multiplied by the employment multiplier, as shown in Table 2, to obtain the combined direct, indirect, and induced effects of the employment multiplier.

The income loss is shown in Table 13, column 2. The initial loss is shown first and the multiplier loss follows. The initial loss was from Table 12, column 1. The combined direct, indirect, and induced income effects were obtained by multiplying the initial loss by the income multiplier as shown in Table 5.

The combined income loss ranged from 143,219 dollars in Area 2 to 756,820 dollars in Area 3.

By comparison of columns 1 and 2 of Table 13, employment and income multiplier losses were contrasted. The income multiplier loss in terms of number of full time jobs was consistently higher than the employment multiplier

loss in terms of income. This difference was associated with the differences in calculating the two types of multipliers.

Implementing Reduction in Grazing

A reduction in the amount of grazing allowed to the ranching sector could be expected to decrease their incomes by the amount of money it took to replace their forage supply. It was assumed that the replacement of the forage supply was from private ranges. The amount by which the grazing was reduced was assumed to be 50 percent. Thus, by again taking the data from Table 10 for the number of AUM's per forest and multiplying these by the respective replacement costs shown in Table 8, the actual cost on national forests was ascertained. And by summing these costs by demand areas, the cost to each area was obtained.

For the BLM districts the total AUM's per district were multiplied by replacement costs. The AUM's per district and replacement costs are shown in Tables 11 and 6, respectively. These costs were summed by demand areas to obtain the costs of each associated with a reduction in grazing.

As before, the combined dollar amounts of loss to the ranching sector for each demand area are shown in Table 12, column 2.

Employment and income effects on demand areas

The initial employment loss, as shown in Table 14, column 1, was calculated for each demand area. The method by which this was accomplished

is as follows. The dollar loss, in $1,000 increments, was multiplied by the E/I ratio for each demand area. The dollar losses and E/I ratios were taken from Tables 12, column 2, and 6, respectively.

The results are shown in Table 14, column 1. The initial loss in employment is shown first. This was the direct employment loss to the respective demand areas due to the decrease in the ranching sector's income.

The multiplication of the initial loss by the employment multipliers, as given in Table 2, gave the combined direct, indirect, and induced effects of the decrease in income. The loss in employment varied from 16.32 jobs in Area 2 to 239.03 jobs in Area 7. The employment multiplier entails successive rounds of spending that take place in a demand area. These successive rounds are the direct, indirect, and induced effects.

The income loss is shown in Table 14, column 2. The initial income loss is followed by the multiplier loss. The initial loss was from Table 12, column 2. The combined direct, indirect, and induced income losses were obtained by multiplying the initial income loss by the income multipliers, as shown in Table 5.

The combined income losses ranged from 443,900 dollars in Area 2 to 1,999,612 dollars in Area 7.

The comparison of columns 1 and 2 of Table 14 gave a contrast of the employment and income multiplier losses. The income multiplier loss in terms of full time jobs lost was consistently higher than the employment multiplier loss. This difference was associated with the methods used in

calculating the multipliers. The income multiplier loss in terms of dollars was also consistently higher.

Implementation of Productivity Changes

An increase in the ranching sector's income associated with a 30 percent increase in the carrying capacity of the public ranges is shown in Table 12, column 3. This dollar value was obtained, for national forests, by tabulating the AUM's per forest as shown in Table 10 and multiplying these AUM's by the replacement cost for each respective forest. The replacement costs are shown for each forest in Table 8. These dollar values were then summed for each demand area.

In the case of the BLM districts, the AUM's per district in Table 11 were multiplied by the forage replacement costs for each district. The costs are shown in Table 7. In a similar manner these dollar amounts were summed by demand area. The combined dollar amounts of an increase in the ranching sector's income on BLM and forest lands are shown in Table 12, column 3.

Employment effects on demand areas

The initial gains in employment due to an increase in productivity of public ranges are shown in Table 15, column 1, for the demand areas. This initial gain in employment was due to the direct effects of the increase in income of the ranching sector.

The combined effects of the direct, indirect, and induced change in the amount of outlays required by the ranching sector is shown by the multiplier gain. This employment gain is shown in Table 15, column 1. The spread in employment gained ranged from 18.22 jobs in Area 2 to 273.32 jobs in Area 7.

The initial gain in employment for each demand area was calculated as the product of the E/I ratio, as shown in Table 6, and the dollar amount obtained from Table 12, column 3. This procedure was repeated for the eight demand areas.

The employment multiplier gain for each demand area was obtained as a product of the employment multipliers and initial employment gains. Employment multipliers and initial employment gains are shown in Table 2 and Table 12, column 3, respectively.

Income gains are shown in Table 15, column 2. The initial dollar gain is followed by the multiplier gain. The initial income gain was obtained from Table 12, column 3. The combined direct, indirect, and induced income gains were obtained by multiplying the initial gains by the income multipliers. The income multipliers are shown in Table 5. This procedure was followed for each demand area.

The dollars gained ranged from 262,285 in Area 2 to 1,394,158 in Area 7.

Again the employment and income multipliers were contrasted. A common base of number of full time jobs is given in Columns 1 and 2 of

Table 15. The income multiplier gain surpassed the employment gain in all eight demand areas. The difference in the employment and income multipliers was associated with the manner in which they were calculated.

Qualification of Results

In using the export-base approach to the economic base, a linear production function is implied. Further, it was assumed that the supply of inputs were inelastic over the range studied.

The cross elasticities of labor supplied and demanded were considered zero; hence, there was no labor substitution in the demand areas.

The diversity and size of the labor market in some areas suggests the possibility of easy substitution of labor. For example, Area 2 would have a high rate of labor substitution due to the diversity and size of its labor market. Therefore, employment impacts will show little effect. In contrast, Area 7 would provide little possibility for labor substitution because of its limited diversification and small labor markets. Employment impacts in these areas could be expected to have significant effects on employment.

Levels of unemployment, shown in Table 16, give an indication of the amount of labor substitution that might take place by demand area.

Table 16. Unemployment rates by demand area--1963

Area	Unemployment rate (percent)
1	3.99
2	6.05
3	4.01
4	7.74
5	6.77
6	7.36
7	6.83
8	6.73

SUMMARY AND CONCLUSIONS

Statement of the Problem

The use of public lands by individuals has become of concern to the public as a whole. Questions on how, and how much, of the public's land should be used for a particular use, with a limited number of individuals benefiting, have been raised.

This study was concerned with the impacts of public land policy changes on employment and income in demand areas in which the ranching sector obtains its goods and services. The policy changes studied were as follows: (a) pricing change, (b) an increase in the productivity of the public lands by 30 percent, and (c) the reduction in grazing permitted by 50 percent.

Primary Objective and Procedure

The primary objective of this study was to determine the employment impacts to the functional demand areas in Utah which are associated with changes in federal grazing policy. Various proposed policy alternatives were evaluated for their impact on the demand areas.

The amount of forage supply obtained from each national forest and BLM district was divided into eight functional demand areas by the permittee holder's residence. By this method the dollar impact on each demand area was traced from its source.

An employment multiplier was calculated using the minimum requirements technique. The E/I ratios were calculated for each demand area. These ratios were multiplied by the loss or gain in dollars to the ranching sector's income in $1,000 increments. This gave the initial losses or gains in employment. The initial gain or loss multiplied by the employment multipliers gave the combined direct, indirect, and induced effects due to a change in the gross outlays of the ranching sector for each demand area.

The income multiplier was calculated using the basic-service approach. Basic income was divided into total income for each area to obtain the income multipliers. The direct income loss to each area was multiplied by the income multiplier to obtain the combined direct, indirect, and induced effects.

The income multiplier effect was converted to an employment base to facilitate comparison of the employment and income multiplier effects.

Results

Fee change

The initial employment lost due to the fee change varied considerably from demand area to demand area. The initial employment loss varied from a low of 5.28 full time jobs in Area 2 to 90.47 full time jobs in Area 7. The employment multiplier loss also varied--again with a low in Area 2 of 9.98 full time jobs to a high of 148.37 full time jobs in Area 7.

Initial income losses ranged from 33,958 dollars in Area 2 to 348,765 dollars in Area 7. The income multiplier loss ranged from 143,219 dollars in Area 2 to 756,820 dollars in Area 7.

The extreme low in Area 2 and high in Area 7 reflect their respective low and high number of permittees residing in each demand area. And the amount of AUM's that could be attributed to each permittee holder. The total employment in each demand area was another factor in the spread in employment and income losses.

The income multiplier loss was converted to an employment base and number of full time jobs lost. This facilitated comparison with the employment multiplier loss. The income multiplier loss in terms of jobs lost was consistently higher than the employment multiplier job loss. This reflected the difference in which the employment and income multipliers were calculated. The employment multiplier was calculated using the minimum employment requirements technique. The income multiplier was calculated using the basic-service relationship.

Productivity change by 30 percent

The initial or direct effect of this type of productivity change would be expected to result in a gain in employment or income for each demand area. The initial employment gain ranged from 9.64 full time jobs in Area 2 to 166.66 full time jobs in Area 7. The employment multiplier gain ranged from 18.22 full time jobs in Area 2 to 273.32 full time jobs in Area 7. This multiplier loss encompassed the direct, indirect and induced employment gains.

The initial income gain varied from 62,006 dollars in Area 2 to 642,469 dollars in Area 7. The income multiplier gains varied from 262,285 dollars in Area 2 to 1,394,158 dollars in Area 7.

Again, the low in Area 2 and the high in Area 7 may be attributed to the number of permittees in each demand area, the number of AUM's each permittee held, and the number of total employment in each area.

The income multiplier gain was converted to an employment base, number of full time jobs. A comparison of the employment and income multipliers was then made. The income multiplier effects were consistently greater than the employment multiplier effects. This difference was associated with the previously mentioned methods of calculating each.

Reduction in grazing by 50 percent

The initial effect of the deferred grazing change could be expected to result in a loss of employment and income in the demand areas. The initial employment loss ranged from 16.32 full time jobs in Area 2 to 239.03 full time jobs in Area 7. The combined direct, indirect, and induced employment losses ranged from 30.84 full time jobs in Area 2 to 392.01 full time jobs in Area 7.

The initial income loss varied from 104,941 dollars in Area 2 to 921,480 dollars in Area 7. The income multiplier loss varied from 443,900 dollars in Area 2 to 1,999,612 dollars in Area 7.

As in the previous policy changes, the lows in Area 2 and highs in Area 7 can be attributed to the number of permittees in each demand area. Also, the number of AUM's held by each permittee holder and the number of total employment in each demand area.

When the income multiplier loss was converted to an employment base, the income multiplier loss was consistently higher than that of the employment multiplier loss. This difference reflected the methods used in calculating each multiplier.

Conclusions

Change in federal land policy do have employment and income effects on the functional demand areas. But whether they are significant or not is open to debate. The percentage of total employment lost of total employment for each functional demand area ranged from .0159 percent for Region 2 to 4.031 percent for Region 7. This was the maximum employment loss or gain to the demand areas. All other gains and losses in employment within functional demand areas were between this maximum and minimum. Income changes followed a similar pattern.

It seems likely that very little actual migration of labor will take place because of the policy changes studied in this paper. More likely, the loss in employment or income due to the pricing and reduction in grazing changes will result in a higher degree of underemployment in each of the functional demand areas, thereby generating even higher unused manpower capacity. The amount of unemployment would probably increase by some small amount also. This entails a waste of a human resource.

In the case of the increase in productivity change, it seems likely that the gain in employment or income will not create an influx of migration labor. Instead, the underemployed or individuals with unused capacity could absorb

the new jobs, in which case most of the increase would show up as increased productivity. If still more labor was acquired in the area, the unemployed would be provided with new opportunities for employment.

Suggestions for further research

This study has opened several areas in which more meaningful questions need to be answered. There are several areas which were treated superficially or only mentioned and which merit further consideration for research. A brief list of these includes:

1. How can the problem of underemployment and other unused capacity be measured and interpreted meaningfully?

2. How can the influence of underemployment on regional multiplier effects be measured?

3. Do the cross-elasticities among inputs, especially types of labor, vary significantly between functional demand areas?

4. What are the cross elasticities of labor demand in Utah's sub-state labor markets?

5. What is the social make-up of the rural communities including the customs, traditions, etc., which affect decisions to migrate to other areas?

6. How can we analyze the productivity of employment in different sectors of the economy and the differences of productivity in rural and urban settings within the same sectors.

Further research should be conducted in the fore-mentioned areas. Particular emphasis should be placed on the feasibility of measuring underemployment and on providing a meaningful interpretation thereof.

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APPENDIXES

Appendix A

Definitions

Functional Demand Area--An area which is a geographic unit with major and minor service centers and areas to serve the population of the unit, where some degree of social relationship has developed. The term "functional demand area" will be used interchangeably with the term "multi-county region."

Service Center--Service centers are population concentrations within which are clustered various agencies or organized groups that are established to provide for the wants and needs of the population, whether economic, social, psychological, religious, or educational.

Service Area--A service area includes the territory adjacent to the center in which people receive or obtain various services. These may or may not conform to the political boundaries of the region.

Social Relationship--Social relationships are patterned mutual rights and obligations resulting from interaction. The relationships may develop from obtaining or providing services, or from reciprocal activities with varying degrees of social organization, or from a combination of these.

Appendix B

Multi-County Regions

Multi-county regions are not based upon any single type of data, but upon data of three types:

1. Statistical analysis of service areas and service centers in Utah.
2. Tabulation of intrastate classifications of regions.
3. Consideration of various forms of organized inter-county activities.

Multi-counties are listed below, together with reasons for their combination into FEA's.

Area 1 - Box Elder, Cache and Rich Counties

The city of Logan serves as a comprehensive service center, serving Cache County, Rich County and some smaller communities of Box Elder County with its high agricultural production and government-supported industry, although the city is somewhat intertwined with Ogden. Geographically, the three counties are related, even though Rich County is separated by the mountains.

The three counties are frequently classified by agencies, groups and planning areas into an intrastate region. This results in the counties identifying together and in interaction among members of associations in the area.

Rich, Cache and Box Elder Counties meet together to discuss mental health, public health, and highways. A community Action Program is sponsored jointly by the three counties. Finally, even though no formal organization exists among the three counties, each has associated with others about locally shared problems.

Area 2 - Weber, Morgan and Davis Counties

As a metropolitan center, Ogden strongly draws workers and business from Morgan County and north Davis County. There are also more workers employed in the northern part of Davis County than in the southern part, which indicates considerable reciprocal labor exchange between Weber County and north Davis County. The highway system does provide for a great deal of interaction between Davis County and Salt Lake City, but for a greater part of the Davis County area, Ogden seems to be a more natural service center.

These three counties are frequently classified together as an intra-state region (21 times in the Fitzgerald study). As a matter of fact, these counties were classified together more than they were involved in any other combination with surrounding counties.

Gathering for discussions of mutual problems has seldom occurred although these three counties have met with others to discuss drainage and roads, and to make plans concerning study of boundary lines. Weber and Davis Counties belong to the Wasatch Front Committees involving taxes, planning, and building codes. (The Wasatch Front counties do share meetings and discussions on many similar issues. However, the inclusion of these complex metropolitan districts--Ogden, Salt Lake, Provo--into one region, without the economically and socially related adjacent counties, falls short of a logical and customary approach. Such a division is seldom considered by government agencies or organized groups.)

Area 3 - Salt Lake, Tooele and Summit Counties

The strong economic and social ties of Salt Lake County and suburbanized Tooele County seem obvious. Although sections of Summit County remain remote from the influence of Salt Lake City, the county continues to increase its degree of involvement with the metropolis.

Tooele and Salt Lake Counties are combined with high frequency according to the study. Although the frequency of combination between Salt Lake and Summit Counties is not as high, it does occur often, and future ties of Summit County appear destined to move in the direction of Salt Lake City.

Roads, the commuting public, and land controls are problems often discussed jointly by representatives of Salt Lake, Tooele and Summit Counties.

Area 4 - Utah and Wasatch Counties

In Wasatch County, Heber provides most of the services needed for citizens of the county. Specialized agencies are accessible in both Salt Lake City and Provo, but Provo is the nearer of the two. With improvement of the highway through Provo Canyon, increased traffic seems likely in both directions, with the Heber Valley becoming a resort and summer home district for sportsmen and Utah County residents.

Frequency of combination between Utah and Wasatch Counties was not excessively high, but it was significant. Also, other counties with which Wasatch County is combined frequently do not provide strong, convenient

service centers, and those counties are usually strongly aligned with other counties somewhat removed from Wasatch County.

Occasional exchanges by commissioners in regard to roads, drainage, recreational controls, and forest control have transpired.

Area 5 - Uintah, Duchesne and Daggett Counties

Vernal has developed as a center of trade for these three counties and interdependence among the three in economic, industrial, and social areas reinforces the selection of the region as a functioning geographic unit. This particularly applies to Duchesne and Uintah Counties.

The three counties are frequently categorized together as a subdivision of the state by organized groups.

Annually, transient livestock claims bring together clerks and auditors of Uintah, Duchesne, Grand, Wasatch, and Summit Counties. Duchesne, Uintah, and Carbon Counties have consummated a formal agreement on television transmission. Uintah and Duchesne Counties share responsibilities for a county agricultural agent, a home demonstration agent, and visiting nurses. The three counties unite in sponsoring a tourism booth at the State capitol.

Area 6 - Carbon, Emery, Grand and San Juan Counties

Geographic features and linking highways are major factors in this regional unit of southeastern Utah. Price is the main shopping and distribution center. Recently, Moab has increased in size to become a secondary

center serving Grand and San Juan Counties. Mining is the most important economic source of support, and agriculture is being replaced by recreation as the secondary source. In the near future, Emery and Grand Counties will develop ties with Sevier County as Interstate 70 is completed.

Most of the groups which subdivide the state for administrative purposes list Carbon, Grand, Emery, and San Juan Counties as a unit.

There is a four-county wildlife federation. San Juan and Grand Counties meet to explore such problems as 4-H Club camps, economic development, tourism, roads, signs, and others. Carbon and Emery County representatives meet to consider similar problems.

Area 7 - Juab, Sanpete, Millard, Sevier, Piute and Wayne Counties

Economic activities are scattered and diversified among the six counties. Richfield is the largest community and would be considered the regional center, primarily for the central and southern part of the region. Millard, Juab and Sanpete Counties support smaller but fairly self-sufficient communities. There is some mining, particularly in Juab and Millard Counties, but agriculture and small industry predominates. Piute and Wayne Counties lack potential for marked growth, except in the areas of tourism and recreation. Juab County is economically tied to Utah County, and an increased trend in the direction will occur with the completion of Interstate 15.

Piute, Wayne and Sevier Counties are combined with high frequency, while other combinations within the group are fewer but still of considerable tendency to recognize the area as a distinct region.

Primarily because of the existence of the Six County Organization, the area is being recognized and accepted by the federal government and other agencies as a unit. Also, this organization involves itself in a variety of problems and is therefore a significant factor in determining regional lines.

Area 8 - Beaver, Iron, Washington, Kane and Garfield Counties

Each of these counties has developed a small trading center, but Cedar City is the primary regional center, and St. George is supplementary. Panguitch and Kanab serve as the two central centers of Garfield and Kane. Agriculture and mining are the primary sources of income in the area, although there are excellent possibilities for the development of tourism, recreation and outdoor sports.

Combinations occur among the five counties with a consistently high frequency, with only a few minor exceptions. This reflects a growing tendency toward structuring the area as a unit.

The Five County Association is the strongest form of intercounty coordination to be found in the state. Many groups and individuals from each county participate in the meetings and programs. Financial contributions from each county allow united efforts in tourism, advertising, industrialism, water and land control, and planning. In addition, the Sevier River Water Commission brings together Garfield, Piute, Wayne, Sevier, Sanpete, Juab and Millard Counties.

Appendix C

Underemployment [4]

[4]The reader is referred to the article "Rent as a Measure of Welfare Change" authored by E. J. Mishan, 1964, for a more detailed discussion of the rent concept as applied to employment.

In analyzing selected impacts particular concern must be focused toward the factors which mitigate these impacts. Of particular concern in this study was the problem of underemployment.

Underemployment exists when persons in employment who are not working full time would be able and willing to do more than they are actually performing, or when the income or productivity of persons in employment would be raised if they worked under improved conditions of production or transferred to another occupation commensurate with their occupational skills. Underemployment can appear in several distinguishable categories. They are:

1. Visible underemployment. This involves shorter than normal periods of work and is characteristic of persons involuntarily working part time.

2. Invisible underemployment. Characteristic of persons whose working time is not abnormally reduced but whose earnings are abnormally low or whose jobs do not permit full use of their capacities or skills (sometimes called disguised underemployment), or who are employed in establishments or economic units whose productivity is abnormally low.

Two conditions must be placed on the concept of underemployment. These are:

1. Imperfect knowledge regarding employment alternatives.

2. Barriers to mobility of labor (Bradley, 1968).

Reduction in rent, as a measure of welfare cost, can provide a measure of underemployment. Rent is taken to mean the difference between the current earnings of a resource and its earnings in the next best alternative

use. Paul Samuelson indicates that " ... we should term the excess of his income above the alternative wage he could earn elsewhere as a pure rent" (Mishan, 1964, p. 103). Similarly, George Stigler states that rent of a factor is " ... the excess of its return in the best use over its possible return in other uses ... ." (Mishan, 1964, p. 103).

Where individuals own the factors of production , rent can be applied as a measure of return on these factors. A graphic presentation of this concept is depicted in Figure 6. If the distance Ox to the right of the origin measures the supply of labor acquired per unit time, any distance Ox to the left of the origin measures the supply of labor given up per unit time. Similarly, OY above the origin measures the quantity of income received, and OY below the origin, the quantity of income given up. Since this discussion concerns an individual or group of individuals giving up a resource in return for a monetary return, attention is focused on the northwest quandrant of the figure. Y may be defined as all other goods at fixed prices, while X is defined as the price of labor and is allowed to vary. Given these conventions, it is possible to define a precise measure of the difference in welfare resulting from alternative supply prices of labor.

If a price line P_1 is constructed such that it passes through the origin and is tangent to I_1 at A, the individual is represented as in equilibrium where he provides Ox_1 of labor and acquires in exchange OY_1 of income, providing Ox_1 of labor is assumed to represent the underemployment of the individual's factors of production.

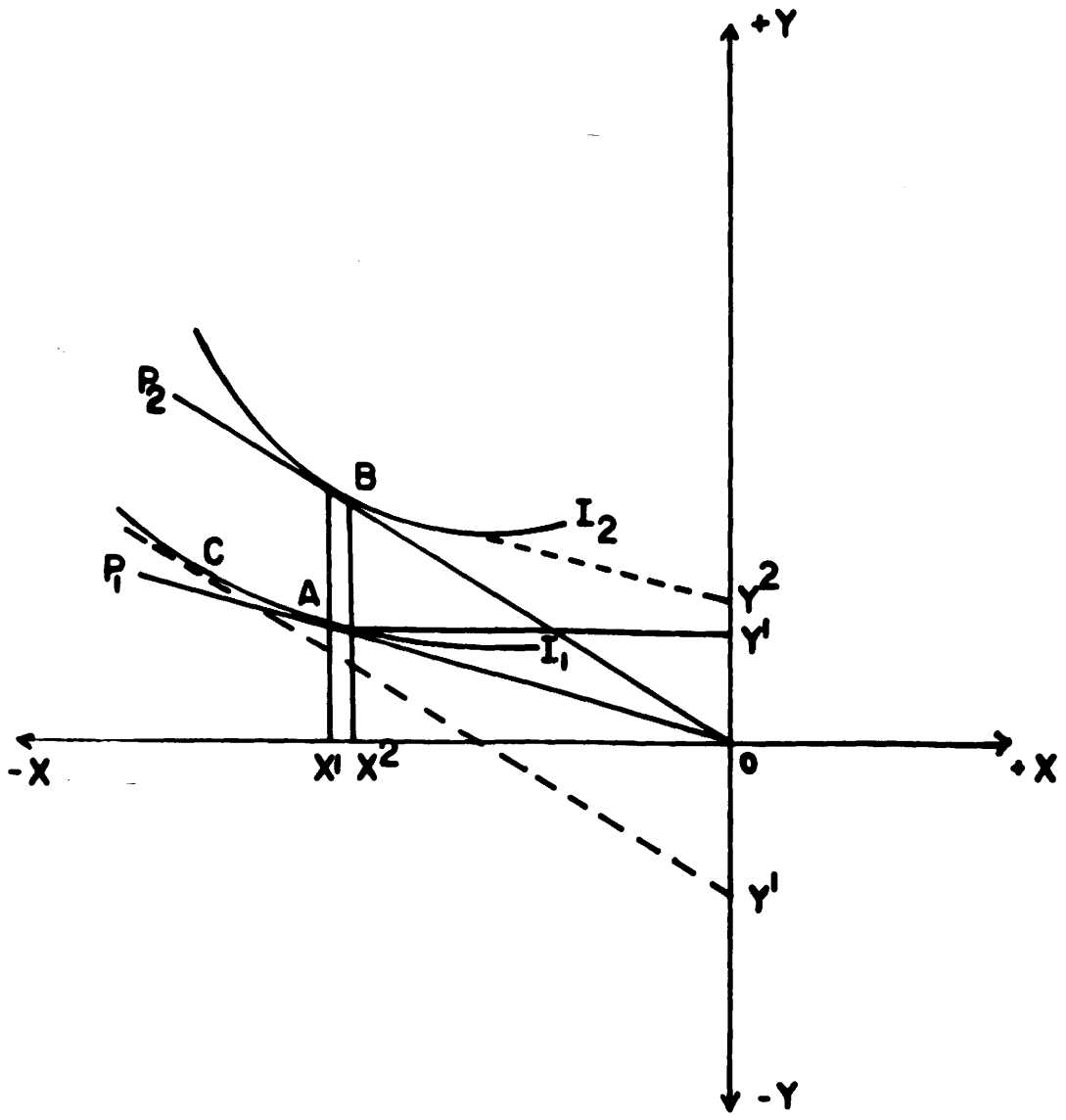

Figure 6. Measures of welfare change.

We can now perform the familiar Hicksian experiment to show the effects of the higher return from the individual's next best alternative use of his manpower resource. The price of x is now increased from P_1 to P_2, which results in a new equilibrium being at B on the indifference curve I_2. The change in equilibrium positions consequent upon the change in the price of labor may be divided into the substitution effect, A to C, and the welfare effect, C to B.

To measure the increase in welfare following a rise in the price of x to P_2 Hicks distinguished between two preliminary measures: the compensating variation (CV) and the equivalent variation (EV). The CV is the amount of y which, following a change in the price of x, has to be given or taken from the individual in order that his initial welfare remains unchanged, as indicated by the indifference curve I. In this instance, the individual's welfare could be improved as a result of the price change, Oy' measures the CV. For if Oy' were taken from his income, he could still maintain his initial welfare position on I_1, given that the higher supply price P_2 is available to him. The EV, on the other hand, is the amount of y which has to be given to, or taken from, the individual to ensure that he reaches the new level of welfare when the changes in price do not apply to him. Since in this instance the increment in welfare is positive, he is to receive a money equivalent. If he receives Oy'', he can reach I_2, the new level of welfare, with the old price P_1, and the rent obviously becomes larger, the lower the initial supply price P_1.

Since the current definitions treat rent as a surplus which may be appropriated without any effects on the supply of the individual's productive services in his current occupation, it is important to observe that in all cases

in which the individual is made to pay or to receive compensation equal to the measures of rent suggested, the amount of the productive service he will then offer will differ from that which he originally supplied at the current price. For example, if having reached B in Figure 6, the individual is made to pay the full CV, equal to Oy', he will no longer continue to supply Ox_2 of labor. Instead, he will supply the amount indicated by the equilibrium point C.

This analysis may be expanded to the case of the supply of productive services to two alternative occupations, A and B, in which, although the individual might choose to work underemployed in each if that were feasible, he is obliged, due to institutional arrangements, to work entirely in the one occupation or the other. This case is demonstrated graphically in Figure 4. Note that Figure 4 is a three-dimensional indifference map with a vertical y axis and two horizontal axes, A and B, which cross at right angles. A vertical slice is cut along the negative Ay plane and along the negative By plane as far as the y axis and remove the segment. Hence, imagine our figure divided vertically into four quarters, the space left after the removal of the vertical quarter in which A and B are both negative. The upper part of what meets the eye is represented by Figure 7. By removing the vertical quarter referred to, the possibility of combining employment A and B has been removed.

Despite the fact that both the rate of pay and resultant earnings are higher in B than in A, the individual chooses to supply his services to A, his equilibrium being at c on the indifference curve I_2 compared with the alternative

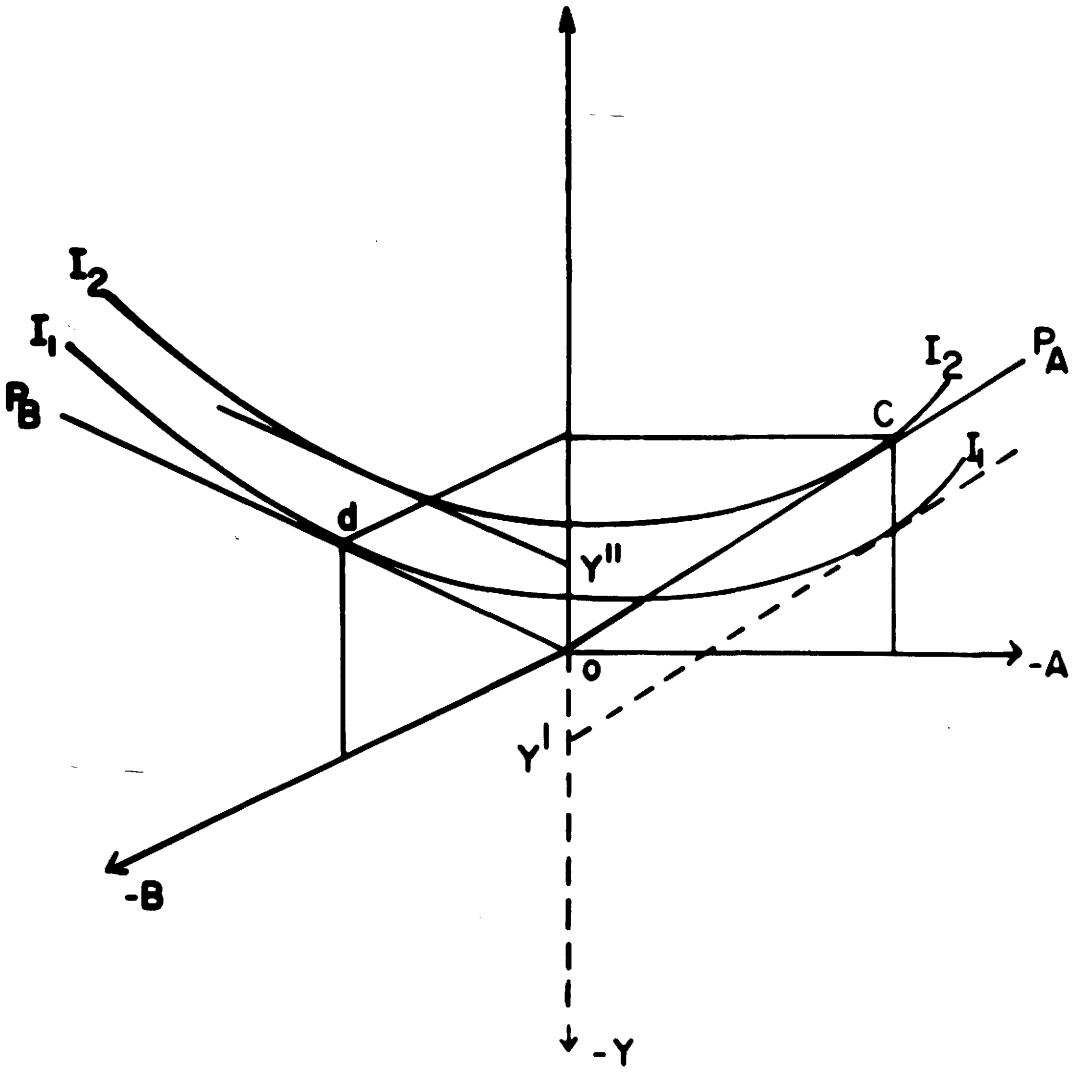

Figure 7. Rent as a measure of underemployment.

equilibrium position d on I_1. Nonetheless, he enjoys a positive rent in the lower-paid occupation A, which can be measured by the CV, Oy'. This represents the maximum he is prepared to pay to remain in A when B, at the existing wage rate, is the next best alternative open to him. It can also be measured by the EV, Oy'' which represents a minimum the individual must be paid in order to induce him to transfer his services from A to B (Mishan, 1964).

An analysis of the comparability of labor and of the returns for labor services in alternative fields of employment encompasses several areas. Differences in pecuniary returns for comparable labor services in various locations may be associated with differences in the cost of living. Also, it is likely that money incomes in urban areas do not provide the same levels of utility to the recipient as do incomes of comparable purchasing power in rural areas. Different social customs may exist in the urban climate, leading to further differences.

There have been several recent attempts to measure the extent of underemployment in the United States. In 1960 Kampe and Lindamood (Goldstein, 1967) cross-classified counties in the United States according to the level of income and extent of underemployment. A summary of some of their more significant findings were:

1. Four out of five counties had low income and some underemployment.

2. Low income and underemployment tend to be associated with sparsely populated counties.

3. The less populated a county, the more likely there was to be severe underemployment.

These findings implied that public policies dealing with geographic pockets of low income require different dimensions as the low income problem is accompanied by underemployment. Similarly, policies dealing with regions of underemployment need to be framed with a view to whether a region has relatively high or low incomes. This study showed percentages of underemployment and man-years of economically unutilized labor in Utah counties--underemployment, 15.1 percent to 56.9 percent and man-years unutilized labor, 63 to 1233 (Bradley, 1968).

Two other recent studies made cooperatively by the Department of Agriculture and the Agricultural Experiment Stations of Kentucky and Oklahoma attempted a more refined approach to the measurement of time input on an annual basis. Interview sample surveys were made of the open country households in economic area 8 in eastern Kentucky and economic area 9 in southeastern Oklahoma, both of which were areas of known low income and levels of living. About 20 questions were used to ascertain as accurately as possible the work record during the year of all persons 14 years of age and over in the open country households. And the study showed the prevalence of greater-than-average underemployment (Bradley, 1968).

It is obvious that in the United States, where the general levels of productivity and living standards are high, the existence of a substantial amount of underemployment in some sectors of the economy stands in contrast to the accepted norms.

Voluntary mobility is a coveted feature of our American democratic economy, and underemployment of farm people and others has been reduced somewhat by the response of these unemployed or inadequately employed workers to better employment opportunities in other jobs and locations.

Even under such favorable conditions for transfer of labor to more productive employment, the United States is still faced with a considerable surplus of inadequately employed workers, especially in non-industrialized rural areas. The problems are accentuated in areas of low-income farms and areas in which mechanization is rapidly diminishing farm labor requirements. The areas are generally those in which the higher level of birth rates in recent decades result in a higher rate of replacement of working adults than can be offset by deaths, retirements, or older men moving out of agricultural occupations.

Replacement ratios for rural farm males of working age during the 1950-60 decade, the ratios indicating the number of young men who will be entering the working age for every 100 older men who will retire or die, is quite alarming. Utah, for example, has a replacement ratio of 160 and over. To date the chief force operating to reduce underemployment has been sustained at high levels of national employment and income which induce voluntary migration and shifts to more productive employment rather than specific programs for areas of concentration of underemployment. However, there are still areas of concentrated underemployment, especially among low-income families. These areas, because of isolation and other factors, still have reserves of unutilized and ineffectively utilized manpower. It is believed a

more detailed study of underemployment would be of great value in promoting economic development and in solving the problems raised by migratory movements and by marked seasonal irregularity of employment, especially in the agriculture sector.

In summary it can be seen that underemployment does exist in rural areas and the presence of underemployment could mitigate the employment impacts due to changes in federal grazing policy.

Appendix D

Table 17

Table 17. Aggregation of industries and classification by basin and service

Industry group	Bradley[a]
All basic oriented industries[b]	
Agriculture	1-3
Manufacturing	11-20
Mining	4-7
Transportation	21-24
All service oriented industries[b]	
Construction	8-10
Trade	25-31
Service and miscellaneous	32-39

[a]Classification by Bradley (1968).
[b]Classification by Fox and Kumar (1966).